SOUTHWEST CORRIDOR STUDY

Gov Doc
Plate only

SOUTHWEST CORRIDOR STUDY

RUGGLES STREET TO WALK HILL STREET BOSTON, MASSACHUSETTS

PREPARED FOR THE SOUTHWEST
CORRIDOR TECHNICAL COMMITTEE

Boston Model City Administration
Boston Redevelopment Authority
Massachusetts Bay Transportation Authority
Massachusetts Department of Public Works
Metropolitan Area Planning Council

IN COOPERATION WITH

United States Department of Transportation,
Bureau of Public Roads

United States Department of Housing
and Urban Development

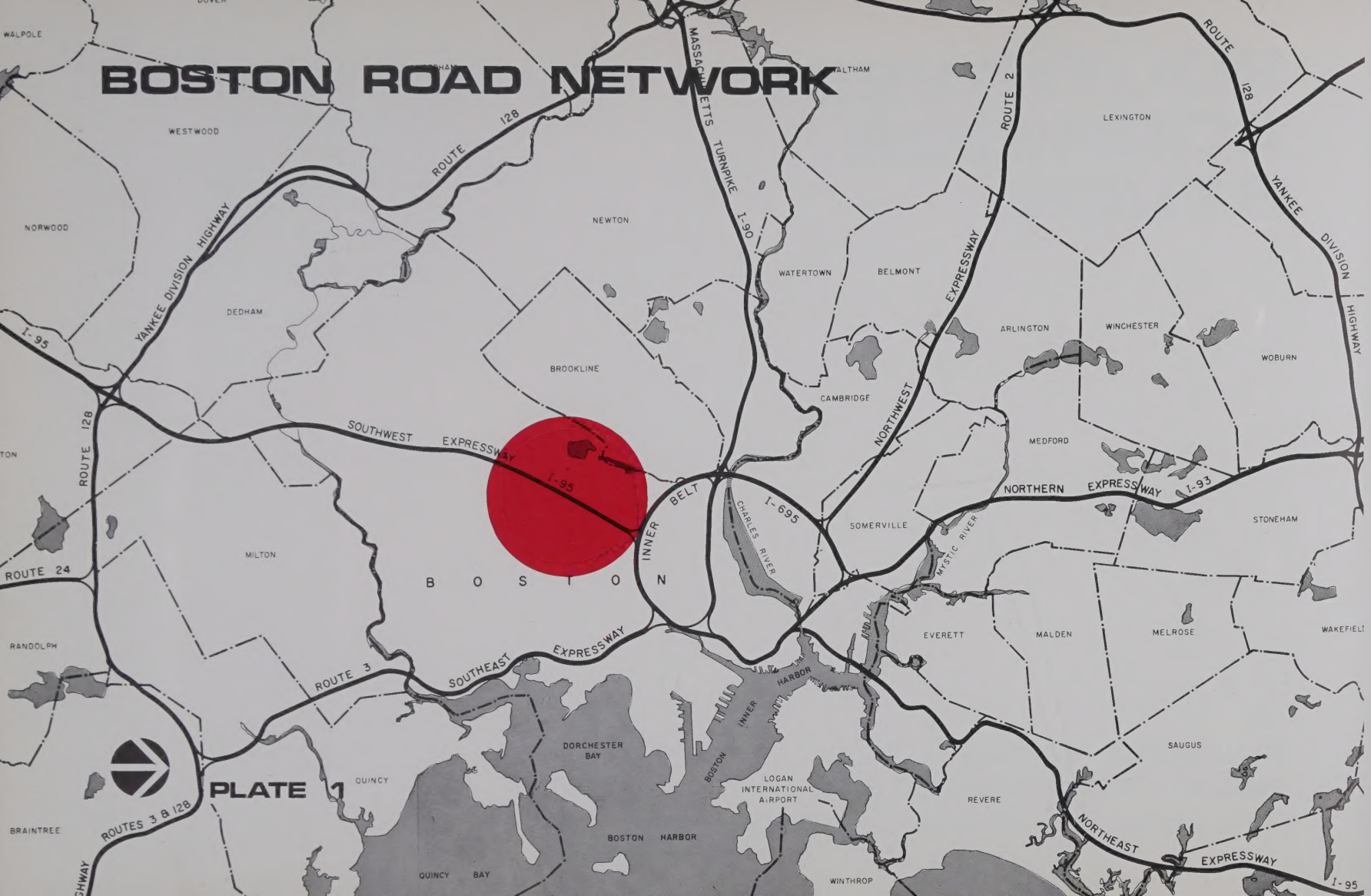
PREPARED BY

The Architects Collaborative, Inc.
Cambridge, Massachusetts

with the assistance of

H. W. Lochner, Inc., Engineers
Boston, Massachusetts

March, 1970


BOSTON ROAD NETWORK
PLATE 1
WALPOLE
WESTWOOD
NORWOOD
DEDHAM
NEWTON
WATERTOWN
BELMONT
LEXINGTON
ARLINGTON
WINCHESTER
WOBURN
BROOKLINE
CAMBRIDGE
MEDFORD
STONEHAM
MILTON
SOMERVILLE
EVERETT
MALDEN
MELROSE
WAKEFIELD
RANDOLPH
QUINCY
BRAINTREE
DORCHESTER BAY
BOSTON HARBOR
QUINCY BAY
LOGAN INTERNATIONAL AIRPORT
REVERE
SAUGUS
WINTHROP
B O S T O N
ROUTE 128
YANKEE DIVISION HIGHWAY
I-95
SOUTHWEST EXPRESSWAY
INNER BELT
I-695
CHARLES RIVER
MYSTIC RIVER
NORTHWEST EXPRESSWAY
ROUTE 2
NORTHERN EXPRESSWAY
I-93
YANKEE DIVISION HIGHWAY
MASSACHUSETTS TURNPIKE
I-90
ROUTE 24
ROUTE 3
SOUTHEAST EXPRESSWAY
INNER HARBOR
ROUTES 3 & 128
NORTHEAST EXPRESSWAY
I-95

SUMMARY OF FINDINGS

This study investigates the potential for joint development within and adjacent to the established three mile corridor of Interstate Route 95 between Ruggles Street and Walk Hill Street in Boston. Two vertical profiles within the corridor were studied at the outset: an embanked profile averaging twenty feet above elevation at grade and a depressed profile averaging twenty feet below grade. A third vertical profile was later tested as a balanced alternative.

EMBANKED PROFILE. Industrial and commercial development is best suited to the embanked profile, both from the point of view of the local communities and the metropolitan area at large. Industrial and commercial development adjacent to an embanked profile represents a good physical transition between the highway and the residential communities, and would create a barrier against noise and air pollution. However, such thorough execution of joint development for the embanked profile must remain theoretical, for it would cause serious depletion of the housing inventory in the involved residential communities. A compromise solution for this profile was developed which emphasizes industrial development near expressway access points but leaves large segments of the residential area immediately adjacent to the exposed embanked highway. The construction cost estimate of this profile for the expressway and rapid transit facilities is $67.3 million.

DEPRESSED TWENTY-FOOT PROFILE. This depressed profile appears at first glance to be the ideal solution. It is a good container of noise and air pollution and it is sufficiently depressed to enable local streets to cross it at grade. However, this profile has two serious drawbacks. The first is the construction cost which is approximately twice that of the embanked profile. The second drawback concerns the communities more directly and involves air rights construction. At twenty feet below grade the highway is below the water table and has to be constructed as a "boat section." The characteristics of a boat section are such that air rights construction is economical only if it is undertaken at the same time the highway is built. The realities of the operating procedures of the various agencies involved suggest that simultaneous construction is not likely to happen. The difficulty with this profile is that without air rights developments it will become a severe divider of the adjacent communities. The estimated corridor construction cost is $129.3 million for this profile.

DEPRESSED TEN-FOOT PROFILE. The level of the roadbed in this profile is above the ground water table through most of the length of the corridor. This results in simpler construction and drastically reduces construction costs to an estimated $87.1 million. Being depressed, the profile offers good noise and air pollution protection to adjacent communities and it permits air rights development independent of highway construction. This profile requires that certain local cross streets arch over the corridor resulting in slight adjustments of the corridor width at five points.

RECOMMENDATIONS. The depressed ten-foot profile is the recommended choice for this section of the I-95 corridor. It offers the communities the advantage of better pollution protection and it presents realistic opportunities for the communities to span the corridor with air rights developments which are independent of roadway construction. And, its cost is reasonable.

Industrial and commercial developments are proposed in areas of highway access points. The zones between access points should reinforce the residential character of the area. Thus, the economic needs and residential aspirations of the adjacent communities would be satisfied.

The continuity of the communities across the corridor must not depend on the speculative vagaries of commercial ventures. To insure appropriate development, three platforms are proposed as an integral part of the highway construction. Two of these platforms, at Green Street and between Boylston and Mozart/Atherton Streets, represent potential sites for low and moderate income housing developments. The third platform, at the Arborway interchange, is proposed to carry the regionally planned open space across the expressway.

The two proposed housing developments are remarkably suitable joint development demonstration projects. Building these projects will go a long way in asserting the credibility of joint development studies and recommendations.

The chart on the following page compares the embanked, depressed twenty-foot, and depressed ten-foot profile designs, summarizing the more detailed discussion contained within the body of this report.

		EMBANKED	DEPRESSED 20 FOOT	DEPRESSED 10 FOOT
CONSTRUCTION	INITIAL LAND TAKINGS	Same as depressed twenty-foot except for small additional takings in Area 8.	Least number of initial land takings.	Same as depressed twenty-foot except for additional takings in Areas 2, 4, 5, and 6.
	CONSTRUCTION COST	$67.3 million (not including cost of platforms).	$129.3 million (not including cost of platforms).	$87.1 million (not including cost of platforms).
	MAINTENANCE COST	Lowest cost.	Some additional costs for snow and storm water removal.	Some additional costs for snow and storm water removal.
USER IMPACT — EXPRESSWAY	DRIVER ORIENTATION	Very good visibility of surrounding communities and distant landmarks.	Least visibility of surrounding community and distant landmarks.	Limited visibility of surrounding community and distant landmarks.
	POLLUTION ON ROAD	Least noise and pollution disturbance to automobile traffic.	Most noise and pollution disturbance to automobile traffic.	Some noise and pollution disturbance to automobile traffic.
	TRAFFIC SERVICE	Same as depressed except for direct connections between Arborway and expressway.	No direct connections at Arborway; no northbound Washington Street south of McBride.	Same as depressed twenty-foot.
	AUTOMOBILE SAFETY	All three profiles equally safe.	All three profiles equally safe.	All three profiles equally safe.
USER IMPACT — MBTA	ACCESS TO STATION	Up through station lobby to platform.	Down through station lobby to platform.	Down through station lobby to platform.
	PASSENGER VIEW	Good view of surrounding communities.	Limited view of surrounding communities.	Limited view of surrounding communities.
COMMUNITY IMPACT	NOISE	Sound transmitted directly to adjacent communities.	Side walls deflect sound away from adjacent communities.	Side walls partially deflect sound away from adjacent communities.
	POLLUTION	Very noticeable at adjacent properties.	Least noticeable at adjacent properties.	Less noticeable at adjacent properties.
	ROADLIGHT GLARE	Can be controlled.	Easier to control.	Easier to control.
	PROPERTY VALUES	Industrial land values will increase sharply; other values will increase generally.	Industrial land values will increase rapidly; other values will increase generally.	Industrial land values will increase; other values will increase most adjacent to air rights.
	VISUAL CONTINUITY	Embankment blocks views of communities on opposite sides.	Communities on opposite sides will be separated by a river of traffic.	Communities on opposite sides may be connected by air rights.

	EMBANKED	DEPRESSED 20 FOOT	DEPRESSED 10 FOOT
DEVELOPMENT POTENTIAL WITHIN CORRIDOR			
RESIDENTIAL	Not feasible in under rights sections because of natural light and ventilation problems.	Limited housing potential since air rights can be developed only on platforms built concurrently with expressway; uneconomical.	Good housing potential for air rights to link residential areas across corridor; can be built at any time.
COMMERCIAL	Retail an appropriate use for under rights; can be developed anytime but limited to sections built as a viaduct.	Limited commercial potential since air rights can be developed only on platforms built concurrently with expressway.	Good commercial potential for air rights, especially at corridor access points; can be built at any time.
INDUSTRIAL	Industry an appropriate use for under rights; can be developed anytime but limited to sections built as a viaduct.	Not economically feasible to utilize air rights for most industrial activities.	Not economically feasible to utilize air rights for most industrial activities.
INSTITUTIONAL	Not feasible to utilize under rights for most institutional activities.	Limited institutional potential since air rights can be developed only on platforms built concurrently with expressway.	Good institutional potential for air rights; can be built at any time.
RECREATIONAL	Open space not normally an appropriate use but at Arborway recommended to maintain visual continuity of green space.	Open space not economical but at Arborway recommended to maintain physical continuity of green space.	Same as depressed twenty-foot.
DEVELOPMENT POTENTIAL OUTSIDE CORRIDOR			
RESIDENTIAL	New housing can be built which will minimize noise and pollution problems and serve as buffer for existing dwellings.	Same as embanked. Most desirable location adjacent to air rights platforms.	Same as embanked. Most desirable location adjacent to air rights platforms.
COMMERCIAL	Greatest potential at corridor access points for concerns dependent upon the regional market.	Same as embanked. Most desirable location adjacent to air rights commercial development.	Same as embanked. Most desirable location adjacent to air rights commercial development.
INDUSTRIAL	Industrial development can effectively serve as a continuous buffer between housing and expressway.	Same as embanked with best potential at corridor access points.	Same as embanked with best potential at corridor access points.
INSTITUTIONAL	Good potential for uses relating to existing institutions, especially for those requiring [illegible]	Same as embanked.	Same as embanked.
RECREATIONAL	Landscaped open space desirable to serve as buffer between housing and expressway.	Same as embanked.	Same as embanked.

ACKNOWLEDGEMENTS

TAC STAFF

Alexander Cvijanovic, Principal in Charge
Perry Neubauer, Job Captain
Tonia Aminoff, Sociologist
Tsunehisa Yamada, Architect
Alice Coggins, Architect
Robert Yelton, City Planner, Architect
Larry Zuelke, Landscape Architect
Robert Erickson, Landscape Architect

LOCHNER STAFF

Robert Mongrain, Chief Engineer
George Stuopis, Coordinating Engineer

CONSULTANTS

James P. Collins and Associates, Geotechnical Engineers, Cambridge

Donald Cook, Urban Data Processing, Cambridge

John McCue, Real Estate Department, Massachusetts Turnpike Authority, Boston

Nichols, Norton and Zaldastani, Consulting Engineers, Boston

Richard Robinson, Sloan School of Management, Massachusetts Institute of Technology, Cambridge

Robert Weiss, Departments of Sociology, Brandeis University and Massachusetts Institute of Technology, and Laboratory of Community Psychiatry, Harvard Medical School, Boston

Appraisers Weekly, Boston

Gaffin Market Research, Inc., Elmhurst, Illinois

CONTENTS

PLATES

PHOTOGRAPHS

Pages 1 and 78 by Julie O'Neill

Page 28 courtesy of the Massachusetts Department of Public Works

Page 41 (upper right) by George Zimberg

Page 71, 72, and 74 courtesy of Nichols, Norton and Zaldastani

All other photographs by Perry Neubauer

SKETCHES

Tsunehisa Yamada

INTRODUCTION

OBJECTIVE

In August, 1969 the Southwest Corridor Technical Committee retained The Architects Collaborative to study a three mile section of the proposed Southwest Expressway which will connect the proposed Inner Belt in Boston with the circumferential Route 128 to the south. This study is concerned with the Boston end of the connector, excluding the interchange with the Inner Belt. The section under study includes three rapid transit tracks as far as Forest Hills and four tracks beyond, two remaining in the corridor and two following the West Roxbury branch of the Penn-Central Railroad.

It was understood that TAC would work closely with and be subject to review by the Technical Committee which is composed of the following five agencies: the Boston Redevelopment Authority (BRA); the Boston Model City Administration; the Massachusetts Department of Public Works (DPW); the Massachusetts Bay Transportation Authority (MBTA); and the Metropolitan Area Planning Council (MAPC). Ex officio members of the Technical Committee are the United States Department of Housing and Urban Development (HUD), and the United States Department of Transportation, Bureau of Public Roads (BPR). The Jamaica Plain Expressway Committee (formerly the Jamaica Plain-Roxbury Expressway Committee) was invited to participate in the Technical Committee meetings. The JPEC is a group of citizens concerned that the plans for the expressway reflect their needs and interests.

The extent to which recommendations could be made for the study area was limited by various decisions and plans made prior to the beginning of the study. Among these were the fixed route of the expressway, its width, the relationship of ramps and connectors, the general location of the rapid transit tracks, and the location of two of the rapid transit stations. This study, described in the "Proposed Work Program for a Study of the Southwest Corridor" submitted to the Technical Committee by the BRA and Model Cities on 22 August, 1969, has a dual purpose:

1) to compare and evaluate an embanked and a depressed vertical profile for a fixed horizontal alignment of the Southwest Corridor expressway/rapid transit facility in terms of costs and benefits to the metropolitan area and local communities involved.

2) to investigate the potential for joint development within and adjacent to the corridor for each profile, and to recommend specific sites for various land uses which would be compatible with existing and future needs of local communities as well as the metropolitan area.

As this report will illustrate, the joint development potential of the corridor depends largely on the final highway design.

SCOPE OF SERVICES

In order to better deal with the complex problems and issues involved in this study, the TAC staff included professionals in the following areas: urban design and city planning, architecture, landscape architecture, sociology, economics, and engineering. This report was prepared in collaboration with H. W. Lochner, Inc., engineering consultants to the DPW and the overall coordinating firm concerned with highway design in the Boston metropolitan area.

APPROACH

It is clear that the Southwest Corridor, as part of Boston's transportation network, will have a far-reaching effect on the development of the region. It has been recognized only recently that non-physical factors play a central role in the planning and design of expressway and rapid transit facilities. Given the need for the transporting of goods and people in and out of the urban core, corridor facilities must obviously meet criteria for good design. However, it is equally important that the corridor respond to existing and future needs of the surrounding communities. Some existing neighborhoods are further separated in the wake of expressway construction. It is the objective of this study to make recommendations which provide maximum opportunities for reintegrating these areas. This is the only way that the Southwest Corridor can become a generator, rather than an inhibitor, of future development.

DESIGN CRITERIA

EXPRESSWAY. Since the primary function of the corridor is to transport vehicles, it is crucial that all alignments and profiles of limited access roads, service roads, ramps, and connectors meet the highest standards to provide a safe, convenient, and pleasant driving experience. Access and egress to the corridor must relate to existing traffic arteries so that accessibility to transportation facilities meets community requirements. Design criteria must also be concerned with minimizing corridor-related noise and air pollution and the amount of land acquisition required for the facility. Prior to this study, the number of traffic lanes had been set as follows: four twelve-foot wide traffic lanes and two ten-foot wide paved shoulders for each direction of traffic flow.

RAPID TRANSIT. Rapid transit stations must be located in response to community needs and reinforce existing public transportation patterns. The relationships between pedestrian walking distances, surface bus lines, and rapid transit station locations must be strongly emphasized so that the residential and business needs of the corridor can be efficiently and economically served. The number of rapid transit tracks, their location in the median throughout most of the corridor study area, and station locations at Jackson Square and Roxbury Crossing were fixed prior to this study. A third rapid transit station location had not been resolved. After consultation with the MBTA, BRA, and DPW, it was agreed that this station should be located at Green Street in Jamaica Plain and that a fourth station be located at a point midway between Morton Street and Walk Hill Street in Roslindale.

JOINT DEVELOPMENT CRITERIA

The term joint development refers to the cooperation by several parties -- public or private, federal, state or local -- in the planning and implementation of projects within or adjacent to an existing right-of-way. Any development within a transportation right-of-way implies joint development since state, federal, or local authorities must grant air rights or under rights to potential developers. Under rights are developments under an elevated expressway or other facility, while air rights are developments over an expressway or other facility.

Joint development projects can be built in any of the three phases of corridor development: prior to construction of the transportation facilities, during their construction, or after they are in operation. Prior construction of air rights housing or commercial developments can ease relocation problems, as can prior construction of under rights commercial or industrial developments.

Both types of joint development within the Southwest Expressway right-of-way offer the advantages of returning land to the tax rolls and stimulating new development adjacent to the corridor. Air rights in particular offer the advantages of providing a means for reuniting the community and considerably reducing the amount of noise and air pollution suffered by those people living adjacent to the air rights developments. In general, joint development is most appropriate:

1) where pedestrian and vehicular access is good;

2) at rapid transit stations which generate large numbers of people;

3) where the proposed developments are compatible with existing uses; and

4) where surrounding property values are such that joint development is economically feasible. (See Appendix A for a discussion of the factors involved in the economic feasibility of air rights developments.)

PLANNING. When joint development is anticipated, the following considerations should be included as part of the transportation planning process itself:

1) anticipation of future traffic needs since once joint development projects are constructed, the expressway cannot be widened;

2) insurance that legal problems involved in the acquisition of air rights and under rights can be solved (ideally, one public agency should both determine the terms and administer the agreements); and

3) application of building codes and zoning ordinances. (See Appendix B for a discussion of air rights planning issues.)

In addition, air rights developments require that provisions be made for clearances to accommodate foundations, and for soil conditions so no extraordinary construction methods are required. (See Appendix C for a detailed discussion of the special construction techniques required for air rights projects.)

UNDER RIGHTS. Specific advantages of under rights joint development projects are:

1) they can be built directly on the ground, requiring no special column spacing as do air rights developments; and

2) they can reestablish the continuity of the communities through the development of viaducts under the corridor.

Disadvantages of under rights are:

1) they can be built only where they have been anticipated and the embanked road has been elevated;

2) they are limited in both height and length by the design of the corridor; and

3) they have limited land use potential because of the limited view, air, and light for the occupants.

AIR RIGHTS. Air rights developments offer more advantages than under rights:

1) fewer restrictions on expansion because of corridor design;

2) a reduction of noise and air pollution for residents adjacent to the development;

3) they allow reintegration of the communities bisected by the corridor; and

4) they can be the focal point for redevelopment.

In addition to the special problems of construction, air rights have the following disadvantages:

1) vehicular access is limited to service roads and cross streets; and

2) provisions must be made for lighting and ventilation of the expressway under the platforms.

STUDY AREA DEFINED

PHYSICAL BOUNDARIES. As defined in this study, the Southwest Corridor is the three mile section of Interstate 95 bounded on the north by the proposed Inner Belt at a point where it could meet either a depressed or embanked profile, and south of Walk Hill Street where a connection would be made with the remaining sections. The width of the right-of-way varies from approximately 200 to 250 feet. The "impact zone" of the Southwest Corridor has been defined by the Technical Committee as the area extending half a mile on either side of the right-of-way.

COMMUNITY BOUNDARIES. While this report refers only to parts of Roxbury and Roslindale, it refers to the entire community of Jamaica Plain which is bisected by the corridor. On the north, the study area includes the central and southwestern sections of Roxbury and on the south, the northern end of Roslindale. Roxbury's Model City Sub-area Two and Jamaica Plain's Sub-area One border the corridor on the east side between Roxbury Crossing and Green Street. The Washington Park Urban Renewal Area in Roxbury is between these two Model City areas. Building Code Enforcement and Conservation areas border the corridor on the west in both Roxbury and Jamaica Plain. The Arnold Arboretum, the Jamaicaway, and South Huntington Avenue border this area on the west and the Forest Hills Cemetery, Franklin Park, and Washington Street border it on the east.

CORRIDOR SUB-AREAS. For reference, land within and adjacent to the right-of-way has been subdivided into the following nine areas by the BRA and these sub-areas will be used in this report:

Area 1 - Ruggles and Roxbury Streets, Roxbury
Area 2 - Roxbury Crossing, Roxbury
Area 3 - Fort Hill and Parker Hill, Roxbury
Area 4 - Jackson Square, Roxbury
Area 5 - Boylston and Mozart/Atherton Streets, Jamaica Plain
Area 6 - Green Street, Jamaica Plain
Area 7 - Carolina/Williams and McBride Streets, Jamaica Plain
Area 8 - Arborway Interchange, Jamaica Plain-Roslindale (Forest Hills)
Area 9 - Walk Hill Street, Roslindale


STUDY AREA
9
8
7
6
5
4
3
2
1
JAMAICA PLAIN
ROXBURY
FRANKLIN PARK
ARNOLD ARBORETUM
Jamaica Pond
JAMAICAWAY
CENTRE
LAMARTINE
AMORY
WASHINGTON
COLUMBUS
PARKER
HUNTINGTON
HUMBOLDT
WALNUT
FOREST HILLS
0 400 1600 3200 FT
PLATE 2

ANALYSIS

LAND USE

Since a major concern of this study is joint development potential, it is important to stress that development implies an evolutionary process starting with existing conditions. For this reason, the following section outlines existing land use patterns as well as the physical characteristics of the area as they relate to the design of the corridor. Although the following uses predominate, a major land use is the transportation since the corridor follows the right-of-way of the Penn-Central Railroad which has defined much of the land use in the area over the years.

Land use along the corridor is predominantly residential, although commercial, industrial, institutional, and recreational land uses are also important. The north end of the study area at Ruggles and Tremont Streets in Roxbury borders large scale institutions which are currently expanding. Franklin Park and the Arnold Arboretum define the southern end of Jamaica Plain with large areas of green space and recreational facilities. Local retail and commercial development defines the major community streets in Roxbury, especially along Washington Street which continues into Jamaica Plain on the east of the corridor. The major commercial area on the west side of the corridor follows Centre Street in Jamaica Plain. Pockets of non-retail commercial and industrial development cluster adjacent to the corridor at the northern end of Roxbury and at the Arborway interchange. Except for the area between the corridor and Washington Street, Jamaica Plain is relatively free of industrial development.

RESIDENTIAL. Housing throughout the study area tends to be medium density single and multiple family housing units built between 1890 and 1940. Most of the single family units are to the south in Roslindale and to the west in Jamaica Plain. Typical dwellings are three story frame buildings housing three to six families. The nine public housing projects within the study area provide 3,491 units, 108 of which are specifically for the elderly. The latter housing was built between 1940 and 1953.

RETAIL COMMERCIAL. Most of the retail commercial development in the area serves local rather than metropolitan or regional needs. On the basis of a 1964 Boston Globe study of retail commercial activity, nineteen shopping districts were located in the study area. The nineteen were classified as either "local", "minor", or "intermediate", by the Globe, while none was classified as "major" or "regional". At the time of the survey, fifteen percent of the stores in the study area were vacant, and as early as 1963, thirty percent of those in the right-of-way were vacant.

The three largest districts had over 100,000 square feet of retail space in 1964 and were located at Dudley Square in Roxbury (700,000 sq. ft.), in Jamaica Plain at Centre and Burroughs Streets (132,000 sq. ft.), and Roxbury Crossing at Tremont Street and Columbus Avenue in Roxbury (107,000 sq. ft.). Dudley Square, the largest retail area outside of Boston's central business district and the center of Boston's black community, faces an uncertain future because of the relocation of rapid transit service from Washington Street to the corridor. However, when the elevated transit structure is removed, the shopping and retail environment will be improved. The retail development at Roxbury Crossing has been virtually eliminated by land acquisition for the corridor.

NON-RETAIL COMMERCIAL AND INDUSTRIAL. Non-retail, non-service commercial establishments such as automobile service facilities which tend to use land as small scale industrial developments do are concentrated at the north end of the study area and in the area between Washington Street on the south. Industries in the area are not dependent on the railroad although they are adjacent to it. Unlike retail commercial development in the area, these establishments tend to be regional rather than local in orientation. In 1968, there were 148 manufacturing firms employing over 9,000 people in the study area. The average number of employees per firm was sixty-four, illustrating the small scale of these manufacturing firms. There were also 197 non-manufacturing firms, but the number of people employed by these firms was unavailable.

COMMUNITY FACILITIES AND INSTITUTIONS. Institutional land use in the area favors educational and medical facilities. The study area contains twenty-four public schools and twelve private schools. Two of the public and two of the private schools are high schools and two additional public schools have ninth grade classes. Current plans call for the replacement of a number of these public elementary schools and completion of the first phases of the Madison High School and housing project in the northeast corner of the area, adjacent to the interchange of the expressway and the proposed Inner Belt. Plans are also being developed for a vocational high school on the west side of the corridor beyond Forest Hills.

Private health-oriented facilities such as hospitals and nursing homes are scattered throughout Jamaica Plain and Roslindale.

and have a loose relationship with the medical-institutional complex to the north in the Fenway. The Research Laboratories for the Massachusetts Department of Public Health are located on a large parcel of land between the Arnold Arboretum and the Arborway interchange at Forest Hills.

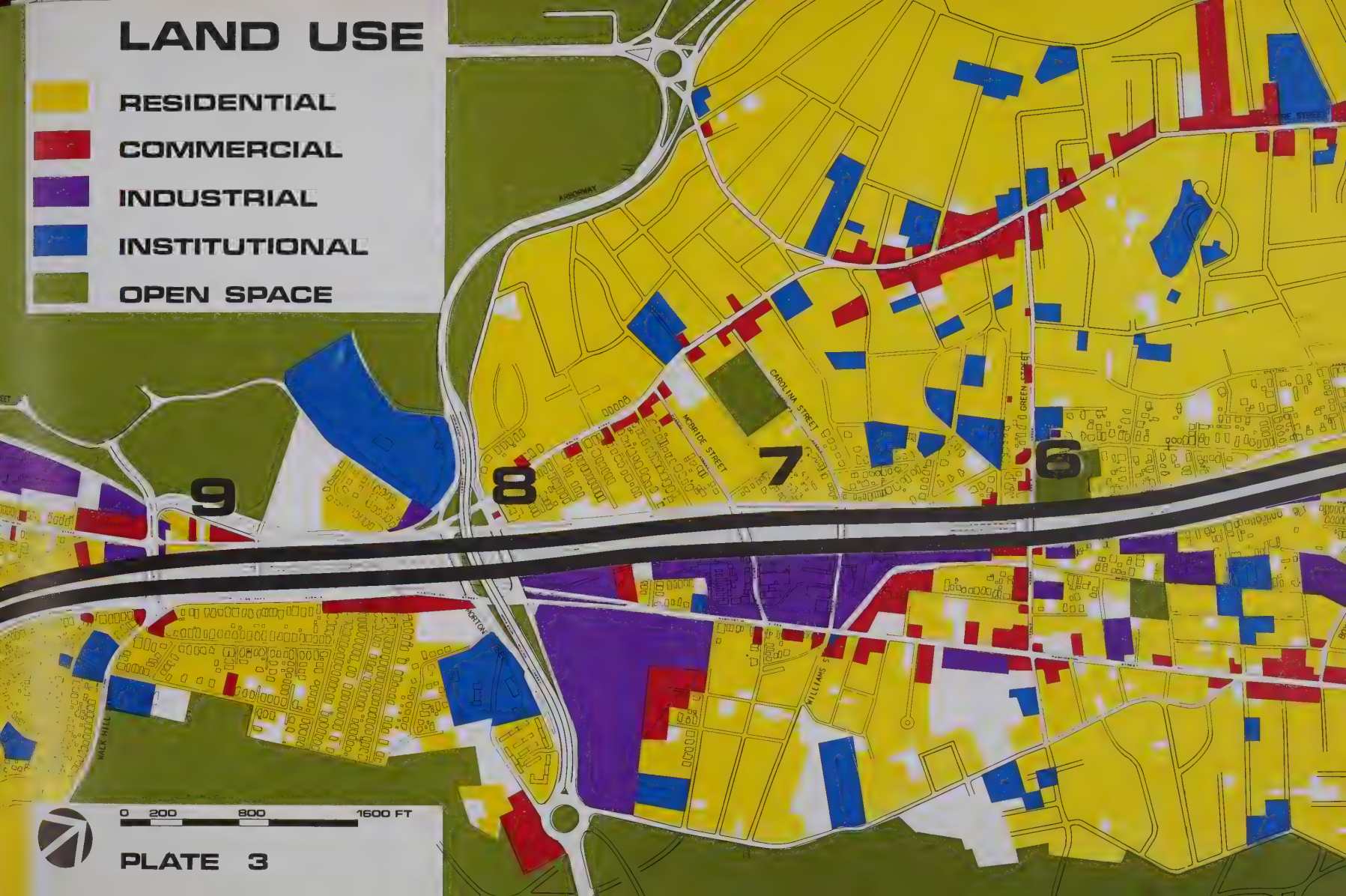
In addition to these regionally-oriented institutions, the area has a large number of churches, societies, and community organizations. The diversity of denominations in Jamaica Plain illustrates its multi-ethnic character while the number of churches and schools and the large property holdings of the Roman Catholic Church in the Parker Hill area illustrate the importance of this tradition in the area.

Other public facilities in the area include four fire stations, two police stations, two municipal courthouses, one welfare office, four libraries, two municipal buildings, three post offices, two public works buildings, three public health facilities, and a public bath. A new police station at Forest Hills is the only new public facility currently in the planning process.

OPEN SPACE. Franklin Park, the Arnold Arboretum, and the Jamaica Pond-Fenway area are some of Boston's most pleasant open spaces and recreational facilities. They were planned in the nineteenth century by Frederick Law Olmsted who conceived of a continuous parkland from the Boston Public Garden to Franklin Park. The road system -- the Charlesgate interchange, the Fenway, the Jamaicaway, and the Arborway -- are restricted to "pleasure vehicles" and maintained by the Metropolitan District Commission (MDC). The continuity of this park system is weakest where the Arborway crosses the corridor at Forest Hills.

The existing institutional and housing land uses on the south side of the Arborway interchange are compatible with the original Olmsted Plan, but on the north side the MBTA car barns break the continuity. An additional twenty-eight small parks and playgrounds dot the study area, although most of them need upgrading and better maintenance.

These green spaces are the developed portions of Olmsted's Park Plan.


LAND USE
RESIDENTIAL
COMMERCIAL
INDUSTRIAL
INSTITUTIONAL
OPEN SPACE
AIRBORWAY
CAROLINA STREET
MCBRIDE STREET
GREEN STREET
9
8
7
6
NORTON
WILLIAMS
WALK HILL
0 200 800 1600 FT
PLATE 3


5
4
3
2
1
MOZART
HEATH STREET
HUNTINGTON AVENUE
ATHERTON STREET
WASHINGTON PARK


5
4
3
2
1
MOZART STREET
HEATH STREET
TREMONT STREET
RUGGLES STREET
ATHERTON STREET
COLUMBUS AVENUE
WASHINGTON PARK BOULEVARD (future)
ROXBURY STREET (realigned)
WASHINGTON STREET
5
4
3
2
1


5
4
3
2
1
MOZART STREET
HEATH STREET
TREMONT STREET
RUGGLES STREET
ATHERTON STREET
COLUMBUS AVENUE
WASHINGTON STREET
WASHINGTON PARK BOULEVARD (future)
ROXBURY STREET
(parallel)
5
4
3
2
1


5
4
3
2
1
T
T
T
T
MOZART STREET
HEATH STREET
TREMONT STREET
RUGGLES STREET
HUNTINGTON AVENUE
ROXBURY STREET (realigned)
COLUMBUS AVENUE
WASHINGTON PARK BOULEVARD (future)
ATHERTON STREET
WASHINGTON STREET
3500'

LAND VALUES

A sampling of property sales since 1960 near the corridor right-of-way indicates that land costs have been highest in those areas which have a significant proportion of industrial and commercial uses. Average land costs are about six dollars per square foot in mixed use areas such as Roxbury Crossing, west of the right-of-way. Land with approximately the same use mixture at Green Street is approximately five dollars per square foot, east of the right-of-way and at Walk Hill Street west of the right-of-way. These current values were calculated with an escalation factor to account for inflation.

The predominantly residential areas average from two to four dollars per square foot less than the mixed-use areas. The residential land at Green Street, west of the right-of-way, averages from two to three dollars per square foot. The Walk Hill residential area, east of the right-of-way, averages over four dollars per square foot, as does the residential and commercial area at Roxbury Crossing. These costs compare with average 1969 residential land costs in Jamaica Plain of about four dollars per square foot, and two to three dollars per square foot in Roxbury.

The two main retail centers in the study area have considerably higher land costs than the residential or mixed-use areas. The Centre Street commercial area averages nine dollars per square foot, and Dudley Square averages seven dollars per square foot.

POPULATION

The Southwest Corridor area has suffered a dramatic decline in population over the past twenty years: on the basis of a 1968 estimate, the population of the area has declined fifty-one percent since 1950 (see Appendix D). Large-scale urban renewal, expansion of the medical institutions, and neighborhood deterioration have all contributed to this decline. These factors make population counts at any given time misleading because people may be temporarily displaced as they await the completion of projects under construction. Nonetheless, as early as 1965 the vacancy rate in the study area was thirty percent, and the last five years have been witness to a large amount of displacement, both directly and indirectly related to projects such as the Southwest Expressway and Madison High School.

The area shows many signs of deterioration which are characteristic of older residential and commercial areas near the central business district. The portions of Roxbury, Jamaica Plain, and Roslindale under consideration in this report have served as a housing resource for many low and moderate income families for several generations. The residential character of these areas, regardless of changes brought by new developments, should be maintained and reinforced as much as possible with new and rehabilitated housing and community service facilities


TOPOGRAPHY
BUSSEY HILL
ARBORWAY
CENTRE STREET
CAROLINA STREET
HOBBIE STREET
GREEN STREET
9
8
7
6
5
FOREST HILLS
WILLIAMS STREET
0 200 800 1600 FT
PLATE 4


PARKER HILL
190
160
130
100
70
40
TREMONT STREET
HUNTINGTON AVENUE
HEATH STREET
MOZART STREET
3
2
1
4
ROXBURY STREET (rail corridor)
FORT HILL
COLUMBUS AVENUE
WASHINGTON PARK BOULEVARD (future)
ATHERTON STREET
WASHINGTON STREET

CIRCULATION

The Southwest Expressway -- Interstate Route 95 north of Route 128 -- follows the Boston and Providence branch of the Penn-Central Railroad. The existing service will be relocated to the Midland branch of the Penn-Central Railroad, which will be upgraded.

AUTOMOBILE. The Southwest Corridor is intersected by several cross-city connectors. The Arborway links the southern section of Dorchester to the Jamaicaway, Fenway, and Charlesgate parkway system. Columbus Avenue, Centre Street, the proposed Washington Park Boulevard, and the Tremont Street extension will bring traffic from Dorchester, Roxbury, Jamaica Plain, and Brookline to the corridor at Jackson Square.

Washington Street on the east and Centre Street on the west, which both come into the corridor at Forest Hills, are the major north-south traffic arteries within the study area. Corridor access points are located at Roxbury Crossing, Jackson Square, and Forest Hills and will serve as local distributors for the areas immediately adjacent to the corridor. These locations are shown in Plate 5 as "access zones".

The Arborway is the extension of the Jamaicaway and links the Arnold Arboretum with Franklin Park as part of Olmsted's Park Plan.

VEHICULAR ACCESS

ACCESS ZONE

CROSS CITY CIRCULATION

COMMUNITY CIRCULATION

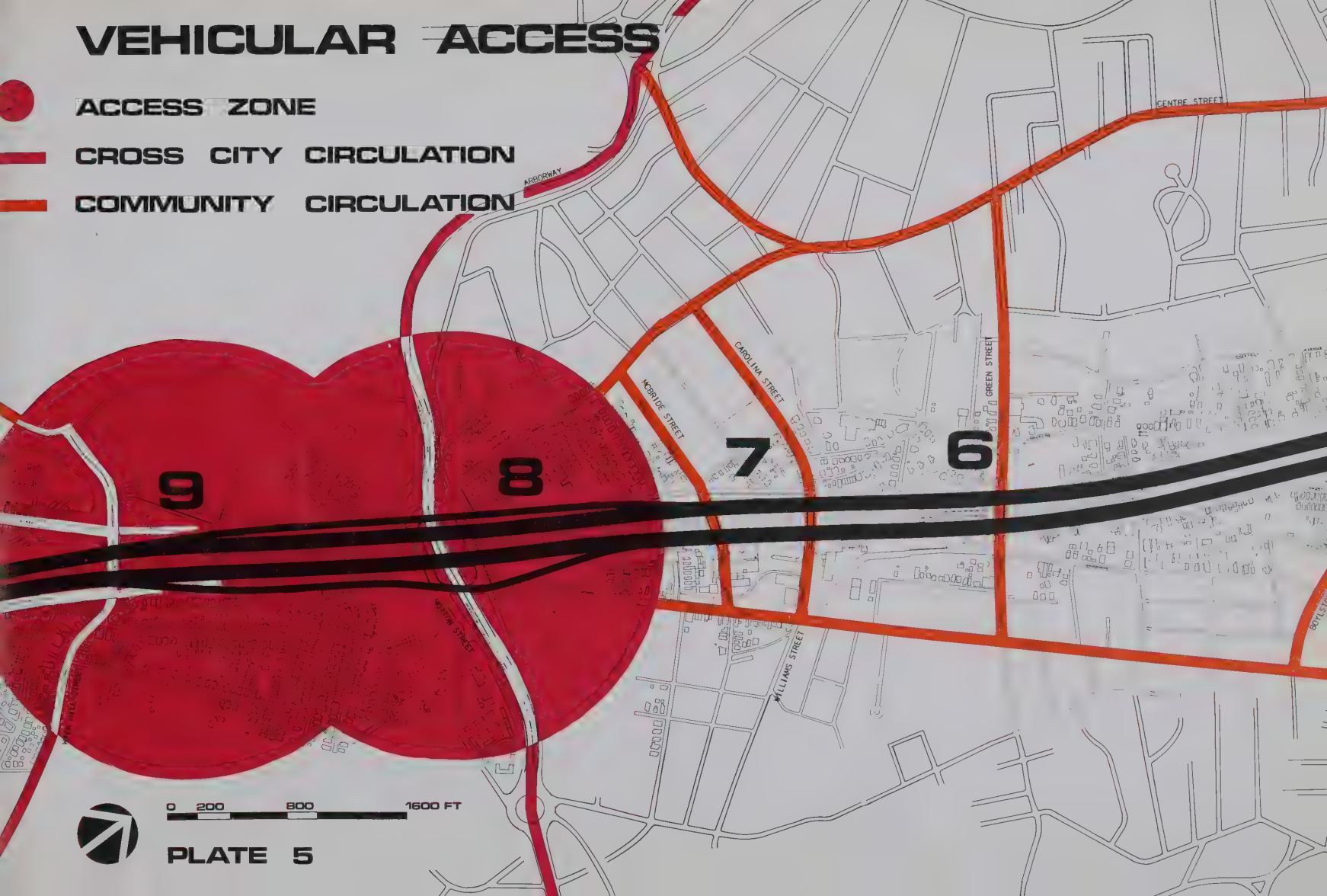


PLATE 5


5
4
3
2
1
TREMONT STREET
RUGGLES STREET
HUNTINGTON AVENUE
MOZART STREET
ATHERTON STREET
COLUMBUS AVENUE
WASHINGTON STREET
WASHINGTON STREET
ROXBURY STREET (realigned)

MASS TRANSIT. The MBTA "orange line" is the rapid transit portion of the Southwest Corridor and runs from Everett to Forest Hills. In the future, the MBTA plans to extend this line from Forest Hills to West Roxbury in the existing right-of-way of the Needham branch of the Penn-Central Railroad along the corridor to Readville.

Street car service along Centre Street in Jamaica Plain (the "green line", from Lechmere to Forest Hills) and the Washington Street elevated provide existing rail mass transit service to the area.

Both of these rail mass transit lines will be replaced by the rapid transit lines in the median of the expressway. The proposed station locations at Roxbury Crossing, Jackson Square, Green Street, and between the Arborway interchange and Walk Hill Street will also be located in the median of the corridor.

The Washington Street "el" will be removed when the new rapid transit facilities are built in the Southwest Corridor.


PEDESTRIAN ACCESS
EXISTING MBTA STATION
PROPOSED MBTA STATION
5 MINUTE WALK
10 MINUTE WALK
10 MIN WALK
5 MIN WALK
9
8
7
6
ARBORWAY
CENTRE STREET
GREEN STREET
CAROLINA STREET
MCBRIDE STREET
NORTON STREET
MILLIAMS STREET
WALK HILL STREET
0 200 800 1600 FT
PLATE 6
4800'
5200'


DESIGN
COMPARISON

PROFILE COMPARISON

ORIGINAL EMBANKED AND DEPRESSED TWENTY-FOOT DESIGNS. When this study of the Southwest Corridor was begun, the embanked profile was in the design-plan stage and the depressed twenty-foot profile was in the preliminary-plan stage. These designs had been prepared for the DPW by Brown Professional Engineers, Inc. The only difference in traffic service between these two profiles was the connector ramps at the Arborway interchange. The embanked design provided a direct connection from westbound Arborway to northbound expressway and from the southbound service road to eastbound Arborway, while the depressed twenty-foot design did not provide these direct connectors.

In both original designs, the West Roxbury branch of the MBTA left the median just south of the Arborway interchange. In the embanked design, the MBTA left the median at Jackson Square on the west side of the corridor continuing between the communities and the service road. In the original depressed design, the MBTA left the median north of Jackson Square, again continuing directly adjacent to the communities. In both original designs, three rapid transit stations were proposed; the Roxbury Crossing and Jackson Square station locations were fixed; and a third was proposed between McBride and Williams Streets in Jamaica Plain.

During the course of this study, agreement was reached between the various public agencies on the location of this last and an additional rapid transit station for both the embanked and depressed designs. The originally proposed McBride and Williams Streets station was moved to Green Street near the present station to serve the Jamaica Plain community. A fourth station was then located just south of the present Forest Hills terminal between Morton Street and Walk Hill Street to serve the Roslindale and Forest Hills communities and the proposed vocational high school. This fourth station is designed with two levels to serve two MBTA lines and its location requires moving the point where the tracks leave the median to just south of the original design.

In the original embanked design, the MBTA left the median on the north end of the study area at Jackson Square, whereas in the original depressed twenty-foot design it left further north near the Washington Park Boulevard extension. This point of departure was changed in the embanked to that of the depressed so that in both designs the MBTA is kept away from the community and is relocated between the corridor and the service road on the west side of the corridor.

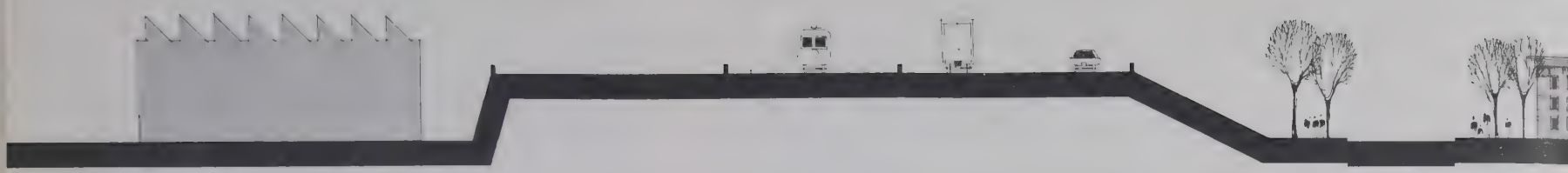
The original objection to the depressed twenty-foot design was its cost. While the embanked design, without joint development platforms, is estimated to cost $67.3 million, the depressed twenty-foot is estimated at $129.3 million, mainly because of the high cost of boat section construction. As the depressed twenty-foot design was studied, it became clear that joint development over boat section construction involves extraordinary problems of phasing and expense.

Joint development is proposed in all three designs, but only in the embanked does this alter the design of the corridor itself. To accommodate joint development, the embanked design would be built as a viaduct to allow for under rights development. Under rights have been proposed for five locations along the corridor and these proposals will be discussed in detail below.

ALTERNATIVE DESIGN -- DEPRESSED TEN-FOOT. As a solution to the difficulties with the depressed twenty-foot profile, a third alternative is presented in this report: the depressed ten-foot design which is estimated to cost $87.1 million. Comparing this design with the two original designs, the major difference is that it is raised above the water table from north of Roxbury Crossing to south of Green Street. This design requires that all of the cross streets and service roads be raised between four and ten feet so that they can properly connect with the corridor. In order to raise the expressway between Jackson Square and Roxbury Crossing, the MBTA must go into a boat section so that it can leave the median under the expressway rather than over it, as in the depressed twenty-foot design.

This design goes into a boat section just south of Green Street to avoid extensive additional land takings at McBride and Williams Streets. The MBTA station locations are the same, as are the points where the MBTA leaves the median on both ends of the study area.

COMPARATIVE SECTIONS



EMBANKED

DEPRESSED 20 FOOT

DEPRESSED 10 FOOT

COMPARATIVE ALIGNMENTS

LAND ACQUISITION

The land necessary for the three expressway designs does not vary greatly and because of this, land acquisition and demolition were begun even though the final design has not been selected. The proposed takings for the original embanked and depressed twenty-foot designs do not include properties in Areas 2, 4, 5, and 6 required for the depressed ten-foot design. Plate 9 illustrates the land acquisition for the three profile designs.

EMBANKED. The embanked design involves additional takings of approximately five structures (two of which are residential) on the southwest corner of the Arborway interchange and a small "v" shaped parcel on the northeast corner of the interchange.

DEPRESSED TWENTY-FOOT. Additional takings for this design are on the southeast corner of the Arborway interchange to allow for the realignment of Washington Street. These takings involve one gas station and one large commercial structure.

DEPRESSED TEN-FOOT. The added land takings required by this design are at Roxbury Crossing, Jackson Square, Mozart/Atherton Street, Boylston Street, and Green Street. Because the profile is only ten feet below grade, the cross streets must be raised between four and ten feet so that they meet the service roads and have adequate clearance over the expressway. (See Appendix F for a detailed description of these additional takings.)

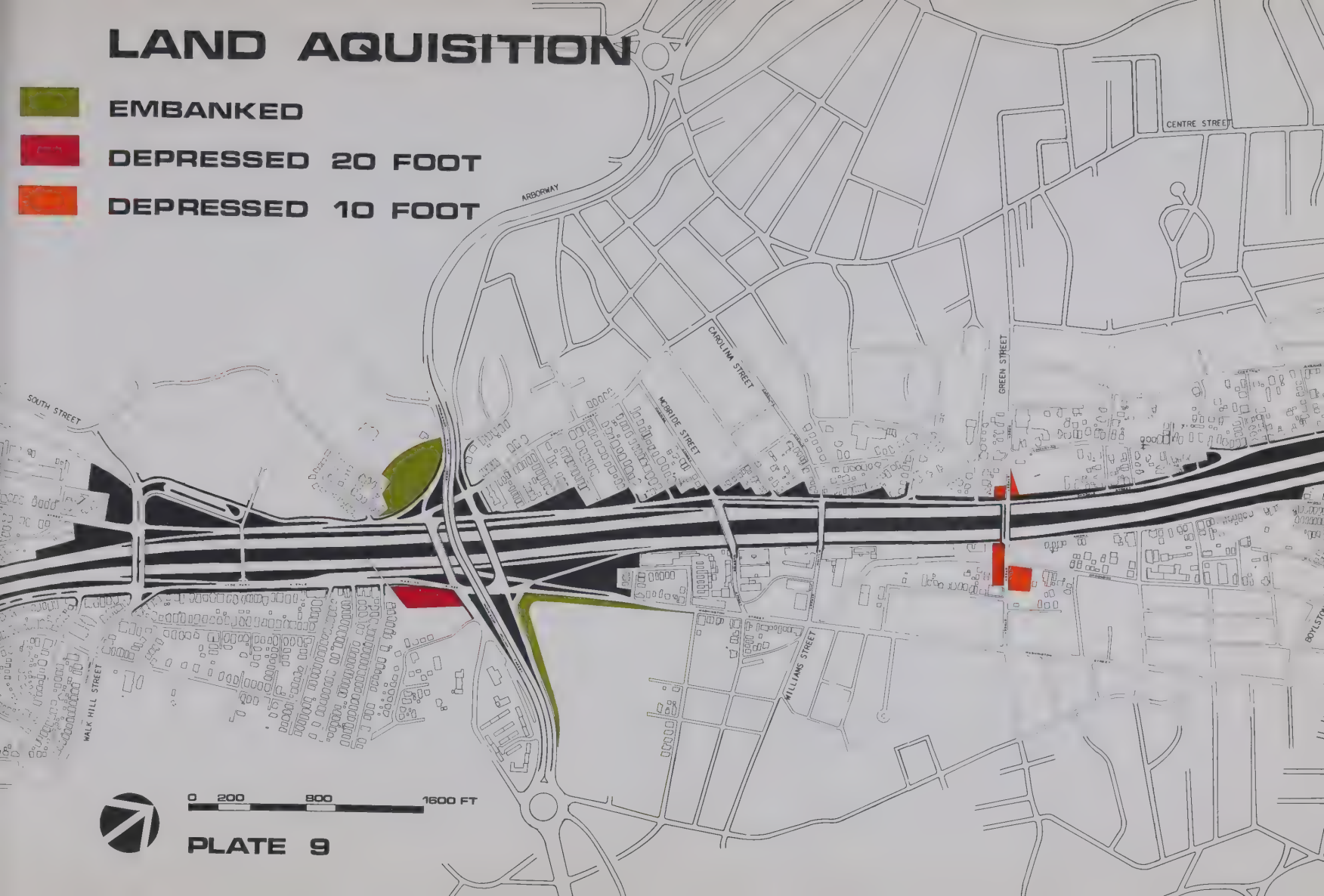
Aerial view of Jackson Square showing the land takings and demolition as of June, 1969.

LAND AQUISITION

EMBANKED

DEPRESSED 20 FOOT

DEPRESSED 10 FOOT



0 200 800 1600 FT

PLATE 9


5
4
3
2
1
MOZART STREET
HEATH STREET
TREMONT STREET
RUGGLES STREET
HUNTINGTON AVENUE
ATHERTON STREET
COLUMBUS AVENUE
WASHINGTON PARK BOULEVARD
WASHINGTON STREET
ROXBURY STREET (realigned)
(future)
5
4
3
2
1


HUNTINGTON AVENUE
TREMONT STREET
RUGGLES STREET
HEATH STREET
MOZART STREET
ROXBURY STREET
(realigned)
ATHERTON STREET
COLUMBUS AVENUE
WASHINGTON PARK BOULEVARD
WASHINGTON STREET

CONSTRUCTION COST ESTIMATES

Cost estimates have been prepared for the three profile designs and include highway construction, rapid transit construction, and platform construction. The estimates do not include land acquisition costs or maintenance costs.

The estimates for the highway construction are based upon 1967 DPW average bid unit prices, with an additional factor included to account for inflation. The estimates provided by MBTA are greater for the embanked design since construction of the MBTA platforms and bridges over the cross streets would be paid by the MBTA. MBTA costs for the two depressed profiles are assumed to be the same.

The estimates for under rights and air rights platforms are based on data derived from similar projects recently constructed in the metropolitan area. The cost of elevated and depressed platforms is assumed to be twenty-five dollars per square foot and does not include costs of buildings on (or under) the platforms or additional lighting or ventilation costs.

EMBANKED PROFILE. Viaduct sections are proposed for all rapid transit stations to provide for future joint development which would be supported by transit patrons, motorists, and local residents. At the Arborway, a viaduct at the Morton Street crossing will maintain the visual continuity between the Arboretum and Franklin Park.

DEPRESSED TWENTY-FOOT PROFILE. Platforms are proposed to be built at the same time as the corridor at all rapid transit stations, at cross streets where housing could bridge the corridor and replace residences and community facilities required for corridor construction, and at the Arborway interchange. This recommendation is made because construction costs for platforms built after the depressed twenty-foot design is constructed will be exorbitant and therefore economically unfeasible.

DEPRESSED TEN-FOOT PROFILE. Platforms are proposed to be built at the same time as the corridor for three specific locations in order to provide replacement housing and landscaped open space. In this case, platforms at other locations could be built and expanded at any time during or after construction of the expressway.

	EMBANKED	DEPRESSED 20 FT	DEPRESSED 10 FT
EXPRESSWAY			
Earthwork	$ 3,769,000	$ 8,828,000	$ 5,714,000
Roadway	4,192,000	2,436,000	3,124,000
Drainage & Utilities	5,297,000	6,223,000	6,223,000
Lighting, Signs, & Signals	1,087,000	1,087,000	1,089,000
Bridges	9,854,000	6,844,000	6,928,000
Walls	4,134,000	8,672,000	5,721,000
Boat Section	-	43,653,000	16,978,000
Miscellaneous	1,739,000	1,754,000	1,754,000
Contingencies	3,007,000	7,952,000	4,753,000
Construction Cost	$ 33,079,000	$ 87,471,000	$ 52,284,000
MASS TRANSIT			
Stations	$ 6,871,000	$ 6,009,000	$ 6,009,000
Bridges	1,479,000	-	-
Trackwork	2,337,000	2,248,000	2,248,000
Signalization	6,450,000	6,450,000	6,450,000
Power	3,756,000	3,756,000	3,756,000
Contingencies	2,089,000	1,846,000	1,846,000
Construction Cost	$ 22,982,000	$ 20,309,000	$ 20,309,000
20% Inflation Factor	$ 11,212,000	$ 21,556,000	$ 14,519,000
CONSTRUCTION COST	$ 67,273,000	$ 129,336,000	$ 87,112,000
PLATFORMS[1]			
Roxbury Crossing	$ 3,100,000	$ 3,100,000	$ -
Jackson Square	5,200,000	7,500,000	-
Boylston-Mozart/Atherton Streets	-	6,000,000	6,000,000
Green Street	1,200,000	3,300,000	3,300,000
Arborway	4,300,000	4,300,000	4,300,000
Construction Cost	$ 13,800,000	$ 25,200,000	$ 13,600,000
TOTAL CONSTRUCTION COST	$ 81,073,000	$ 154,536,000	$ 100,712,000

1. Cost estimates are given only for those platforms to be built at the same time as the expressway.

USER IMPACT

The effect of the design of the Southwest Expressway on the motorist and rapid transit parton is of central importance since the main function of the corridor is the transporting of goods and people. Visual orientation, noise and air pollution, and safety are prime considerations for the motorist, while access to stations and passenger orientation are the two major design considerations for the rapid transit patron.

From the point of view of the motorist, topography, existing buildings, and expressway signs are the features that orient him to his immediate enviornment.

> Not only is vision directed forward, but it is also attracted to the immediate environs of the right-of-way -- the near and apparently "moving" objects, rather than the larger number of distant, seemingly "stable" ones. . . . In the forward view of the multi-lane highway, most of the visual field is filled by the pavement and the sky. . . . Attention is concentrated at the points of decision, such as the beginning of an off-ramp. The details of the object which divides the ramp from the main roadway will loom very large in the driver's total impression and so will distant landmarks, particularly if they are sharply silhouetted.[1]

For the northbound motorist on the Southwest Expressway, the Prudential Tower would be such a landmark and would be seen from different points of view all the way from Route 128. Fort and Parker Hills are the major topographical features, forming a gateway to the city.

With the embanked profile, the motorist would have a long-range view of the surrounding communities. With the depressed twenty-foot profile, the motorist would have little overall view and his attention would be focused primarily on the road and the bridging cross streets. The depressed ten-foot profile would provide a slightly better view of the surrounding communities, but at expressway speeds the motorist's perceptions would be essentially the same for both depressed profiles.

1. Donald Appleyard, Kevin Lynch, and John R. Myer, The View from the Road, Cambridge, Mass., MIT Press, 1964, p. 6.

SAFETY. Research and development in current highway design has eliminated most traffic hazards which could be attributed to specific design profiles. Guard rails are now designed to deflect cars back onto the roadway; highway curvatures and superelevations have been calculated and tested for anticipated expressway speeds; weaving distances and other considerations in the design of connector and access ramps have been considered and tested.

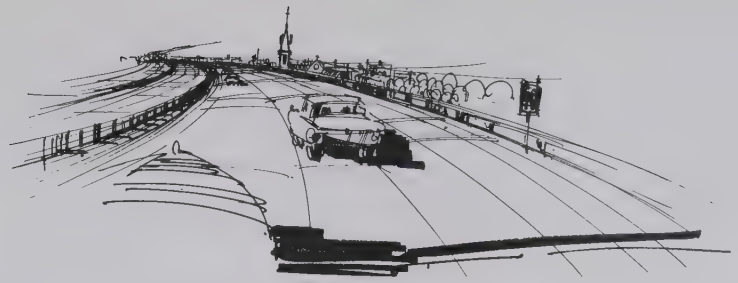
In the depressed designs, the driver entering the expressway has slightly better visibility than in the embanked design. In the depressed designs, gravity assists autos accelerating downhill onto the expressway and decelerating off of it. This advantage is somewhat offset by the potential danger of bridge piers at cross streets to out of control vehicles on depressed roadways.

NOISE AND AIR POLLUTION. Although air pollution tends to remain in a depressed section instead of dispersing as rapidly as it does in an embanked section, the effects on motorists are not great unless traffic is stopped or enters a tunnel. Similarly, noise is not a significant factor to a driver unless it makes conversation with passengers difficult. This noise level is usually reached only in tunnels.

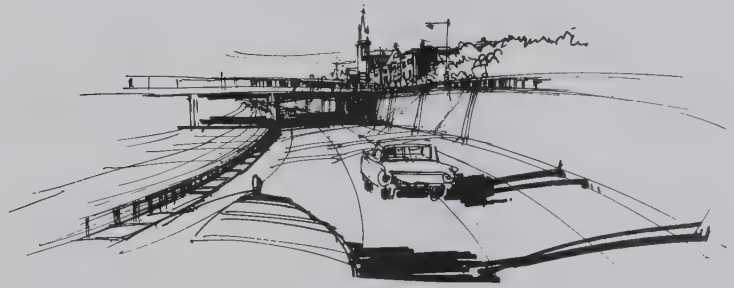
STATION ACCESS. For the embanked design, access to transit stations is from existing street crossings. For both depressed profiles, the stations will be at grade and the transit patron will go down to reach his train.

PASSENGER VIEW. Although visual orientation is not as important for the rapid transit patron as it is for the motorist, there is a difference between the two designs in terms of the view offered to train rider. In the embanked, he has a wider view of the surrounding area, whereas in both the depressed designs his view is somewhat restricted by the sidewalls.

Criteria for good corridor design are much different for the rapid transit patron than for the motorist. The rapid transit patron no longer need worry about noise and pollution since the new MBTA cars are tightly sealed and mechanically ventilated. For the transit patron, safety is assumed. He is concerned only with the ease of access to the station, with the ease of orienting himself once he is inside, and with the view when he is on the train.



VIEW FROM THE ROAD: EMBANKED DESIGN



VIEW FROM THE ROAD: DEPRESSED 20 FOOT DESIGN

VIEW FROM THE ROAD: DEPRESSED 10 FOOT DESIGN

COMMUNITY IMPACT

In attempting to describe some of the effects of the Southwest Corridor on the surrounding communities, two distinctions are helpful. The first involves time: some effects operate prior to construction such as relocation, while others operate only after construction has been completed. The second distinction involves the level of impact: the extent to which a particular consequence involves the area within the right-of-way, areas adjacent to the right-of-way, the local communities, or the metropolitan area. An urban expressway may have a profound regional economic impact because systems of distribution of goods and services change, but this macroscopic impact may not be reflected in areas directly adjacent to the right-of-way.

Before construction has been completed, the most direct impact is experienced by those who have been relocated, and by adjacent residents who have suffered the noise and air pollution and inconvenience of the construction. After the facilities are in operation, noise and air pollution, lighting, property values, and social and physical continuity across the road are the major areas of impact.

Based on 1966 survey data, sixty-one percent of the Roxbury families to be relocated had incomes under $4,800 compared with thirty-five percent of the Jamaica Plain families and twenty-three percent of the families in the Roslindale area. Similarly, sixty-five percent of the Roxbury families, thirty-eight percent of the Jamaica Plain families, and twenty-seven percent of the Roslindale families were eligible for public housing assistance. Data also indicate that since the supply of low and moderate income housing is severely limited, and since most of the relocatees desired to stay in the same area, the problem of finding housing was a difficult one.

Changing school populations is another consequence of relocation. This problem will be felt to a greater extent in Jamaica Plain and Roslindale than in Roxbury because these areas have the greatest proportions of large families affected by the expressway. It has been estimated that over 1,000 children under eighteen are part of the total number having to relocate, and the majority of the families have stated that they prefer to live in the Jamaica Plain and Roslindale communities.

1. All statistics in this section are from unpublished DPW relocation reports, unless otherwise noted in the text.

RELOCATION

RESIDENTIAL. The amount of forced relocation in the Southwest Corridor was minimized because of the existing railroad embankment. As of December 1969, 556 families and 287 individuals had been identified as relocatees by the DPW for the Southwest Expressway. At that time, fifty-two percent of the families and sixty-six percent of the individuals had already been relocated, according to DPW data.

Unlike Jamaica Plain and Roslindale, Roxbury has been struggling with the problem of forced relocation for the past several years. The Southwest Expressway is only one of a number of projects currently involving relocation in the Roxbury area at this time. Roxbury is the site of the interchange of the expressway and the proposed Inner Belt and the Madison High School project adjacent to the interchange. It has been estimated by the BRA and the DPW that approximately 450 households will be displaced because of the Madison High project, and another 400 because of the Southwest Expressway and Inner Belt. Most of these households have already been vacated. Because of the scale of relocation in Roxbury, it is impossible to determine how many families have been forced to move because of the indirect consequences of these projects.

In Jamaica Plain an estimated 168 households were to be displaced. Of these, roughly half have been vacated and the people relocated. Since the families in Jamaica Plain and Roslindale have been living next to the railroad embankment, their property has not been valued as highly as property further into the communities.

BUSINESS. As of January 1970, it was estimated that 443 business establishments will be acquired for the Southwest Corridor. Eighty-four percent (371) have already been taken, and fifty-one percent (226) have already been vacated. Of those vacated, eighty-four percent have been relocated and sixteen percent (35) have gone out of business. Of those that went out of business, most were small individual ownerships. The majority of business relocation in Roxbury has been completed.

Of those businesses forced to relocate, forty-one percent were services, thirty-three percent were retail, eleven percent were manufacturing, ten percent were wholesale, three percent were trucking and warehouses, and two percent were construction establishments.

NOISE POLLUTION

Noise from the roadway is an unavoidable consequence of urban highways. This is a problem primarily within 250 to 300 feet from the highway. Studies in residential areas have indicated that very few people who live further than 300 feet feel that highway noise is occasionally disturbing. The profile of the expressway does not seem to affect the noise level of the neighboring areas at this distance.[1]

Within 300 feet of the roadway, the sound level is affected by many variables such as the height of the expressway compared to existing grade, the time of day, the volume and type of traffic, atmospheric conditions, and the season of the year. Research into sound levels generated by expressways has yielded conflicting data so that it is not possible to predict accurately the noise levels that will exist along the Southwest Corridor. The sounds generated by elevated, grade, and depressed roadways with distances measured from the edge of the traveled way are compared as follows:[2]

DISTANCE FROM ROADWAY	DECIBELS		
	Auto	Truck	General Backround
Elevated			
50 feet	55-66	60-80	48-62
150 feet	54-67	58-76	53-63
300 feet	54-66	55-73	50-64
Grade			
50 feet	59-72	69-83	48-65
150 feet	54-73	64-77	46-72
300 feet	47-69	53-71	42-66
Depressed			
50 feet	65-75	69-77	59-72
150 feet	53-70	58-74	52-68
300 feet	51-69	56-72	46-64

1. John H. Brinton Jr. and Joel N. Bloom, "The Effect of Highway Landscape Development on Nearby Property," Highway Research Board, Washington, D.C., 1969, pp. 18-19.

2. "Abatement of Highway Noise and Fumes," Highway Research Board, Bulletin No. 10, p. 21.

These data indicate that slightly more sound is apparent close to a depressed road than close to an elevated one because sound waves follow lines of sight and pass over the head of the listener in the case of the elevated road. Only at greater distances is the noise from an elevated road greater.

The desirable sound level for residential bedrooms is thirty-five decibels, and fifty decibels is considered the maximum for living areas. The following data illustrate the effect of glass on sound transmitted fifty feet from the nearest traveled way:[3]

TYPE OF GLAZING	NOISE LEVEL	AMOUNT OF REDUCTION	ROOM SOUND LEVEL
Single pane of glass	65db	15db	50db
Double glass, sliding panes	55db	20db	35db
Double glass, operable with ventilation	60db	25db	35db
Double glass, inoperable with ventilation	65db	30db	35db

Landscaped areas are frequently used to reduce the level of noise pollution in neighboring areas, and the following figures illustrate the percentage of sound reduction relative to the highway through a wooded area:

DISTANCE FROM ROADWAY	PERCENTAGE OF NOISE REDUCTION
50 feet	16%
150 feet	21%
350 feet	40%

Since trees lose their leaves, their insulating qualities are virtually eliminated during the winter months. But coincidentally most windows are closed and storm sashes are applied during this time thus compensating for this loss of insulating

3. Journal of Sound Vibrations, Vol. 7, Issue No. 2, 1968, pp. 247-262.

material provided by nature. However, the most successful and consistent method of noise control is the construction of masonry walls, as the following data illustrate:[4]

DISTANCE FROM ROADWAY	AMOUNT OF NOISE REDUCTION	
	10-foot High Wall	15-foot High Wall
50 feet	11db	13db
100 feet	21db	26db
200 feet	31db	38db

From the above tables, it is clear that landscaped open spaces require a large amount of space to serve as effective insulation. In urban areas this means of sound insulation is not practical, although the visual effect is pleasant. The least visually pleasant but most effective sound buffer is a wall which separates the nearby residents from the highway noise. If this masonry insulation is incorporated into the construction of buildings which are joint development projects, maximum sound insulation can be achieved without the negative visual effects of an exposed wall.

AIR POLLUTION

The concentration of air pollutants in transportation corridors is the composite effect of many causes but the principal source of pollutants will be the exhaust fumes from vehicles on the expressway. The amount of air pollution in the corridor itself at any given time will depend on general atmospheric conditions.

Because of the topography ot the area, the fumes from the roadway will tend to be contained in the valley and will be more noticeable at lower elevations than at higher ones. This condition will be most pronounced during periods of air temperature inversion. On calm days, the fumes will be most noticeable in the immediate vicinity of the expressway itself.

Although the elevation of the Southwest Expressway will not significantly affect the general level of air pollution in the communities, it is probable that immediately adjacent properties will be affected most strongly. In general, reports indicate that the level of air pollution is noticeably less in areas adjacent to depressed facilities than in areas adjacent to embanked facilities. Depressed roadways have a tendency to contain the fumes while embanked roadways tend to disperse fumes into the adjacent areas.

4. Brinton and Bloom, "Highway Landscape," pp. 18-19.

LIGHTING

Fixed roadway luminaires and headlight glare from vehicles on the expressway cause unwanted lighting of residential property and are the principal problems that must be faced in the design of the highway, access ramps, and service roads.

The Department of Public Works requires that lighting on highways and access ramps on Interstate Roads maintain a minimum of 0.6 foot candles of light on the roadway surface. These standards are met in all three profile designs for the Southwest Expressway with luminaires placed in the median strips between the highway and rapid transit corridors. The fixtures will be designed so that direct light will fall only onto the travelled surface of the road with only a small amount of reflected light extending past the roadway shoulders. Thus, although fixed lights will be higher in relation to the surrounding community for the embanked profile than for the depressed, highway lighting can be controlled by the proper design of the fixture.

The City of Boston requires a higher intensity of light on local streets because of pedestrian use than is required on highways and access ramps where the intent is to silhouette vehicles rather than to illuminate them. Thus, higher light intensities will exist on adjacent streets than on the corridor itself.

Headlight glare is a problem only at interchanges which contain connector loop roads that face cars away from the highway and into adjacent residential areas. This situation exists on the embanked profile of the Southwest Expressway at the Arborway interchange where existing houses could receive some headlight glare. This problem can be overcome by shielding the roadway with dense landscape materials or special roadway parapet design.

In sum, the existence of the highway will increase the general

level of light and more reflected light will fall into the adjacent residential areas with the embanked than with the depressed design. Direct lighting into the bedrooms of adjacent housing, which is considered to be most objectionable, would result from the lighting of cross streets and service roads rather than from the highway itself.

PROPERTY VALUES

If the impact of the Southwest Expressway on property values follows the general experience of new expressways in urban areas, the effects will occur in several periods. These periods are four: route selection and detailed planning, land acquisition and clearance, construction, and operation.

During the route selection period, the uncertainty regarding the future of individual properties often causes negative changes in property values. Maintenance is often deferred in both residential and commercial structures. This can have quite serious effects on the neighborhood if the preconstruction period persists for a long time. The Southwest Expressway has passed this stage insofar as land acquisition necessary to carry the cross streets over the expressway has been determined. Ninety percent of the land necessary for the corridor has already been acquired. The value changes begun during route selection continue through detailed planning (i.e., engineering design).

When existing zoning is maintained, the values of adjacent property will tend to stabilize as speculation and the decline due to deferred maintenance decrease. If large use changes are proposed, however, deferred maintenance and speculation will continue and probably intensify until the land is redeveloped for its new use. These effects on value do not occur until it is certain that the expressway will be built.

During the land acquisition and clearance period, costs are imposed principally on those living or owning property within the right-of-way. In addition, the removal of large numbers of housing units increases the demand for the housing in the remaining residential areas.

The construction period for major expressways is often several years. During this period the disruptions caused by the movement of equipment, the resulting deterioration of local streets and the closing of streets crossing the right-of-way make local transportation difficult. This may result in decreased profits for on-going commercial and industrial uses which are dependent on local transportation. These losses may be offset for the property owner by increases in property value during the operation period.

Early in the operation period the major changes in land use and development take place because of the great change in the local environment brought about by the highway. Experience has shown that when these changes are the greatest, the impact on land value is greatest. It is during this period that the different effects on land values between a depressed and an embanked expressway begin to emerge.

Because pollution is greater with an embanked profile, the properties adjacent to the right-of-way are less suitable for residential uses. This, combined with increased visibility from the embankment, would favor more intense industrial development. If the demand for industrial land exists in this section of the metropolitan area, the greatest increase in land values might come from existing low-intensity industrial uses, where visibility of commercial signs from an expressway is an asset, and pollution can be more effectively screened out by mechanical devices. If the new industries present no nuisance, it is likely that residential values will remain stable.

It is likely that property values of adjacent land, if designated for residential use, will increase more (or decrease less) when adjacent to a depressed highway than when adjacent to an embanked highway. It is also clear that under rights or air rights development will have a beneficial effect on residential property values adjacent to the right-of-way. A further benefit to both residential and business property values will be the location of rapid transit stations.

In the mature operation period, further increases in land value occur due to increased traffic on the expressway and intensified land uses in adjacent areas. Because of this increased pressure, more and more new development will take place.

The consideration of the general effects of highway development on local property values leads to the conclusion that a depressed design for the Southwest Corridor will most benefit the residential property owners in the area. Air rights construction will further benefit homeowners and increase property values while adding significantly to Boston's real estate tax base. If the embanked design is selected and the demand for new industrial development exists in this area, most com-

mercial land values will increase. However, in this case, strong building and zoning restrictions must be instituted and enforced so that residential areas adjacent to industry will not decrease in value.

SOCIAL AND PHYSICAL CONTINUITY

A considerable amount of planning literature concerned with urban expressways claims that the amount of physical and social damage to urban residential areas is minimized by properly treated depressed facilities. In a report prepared by a group from the Jamaica Plain community in conjunction with a professional planning group, this claim was applied to the Southwest Corridor:

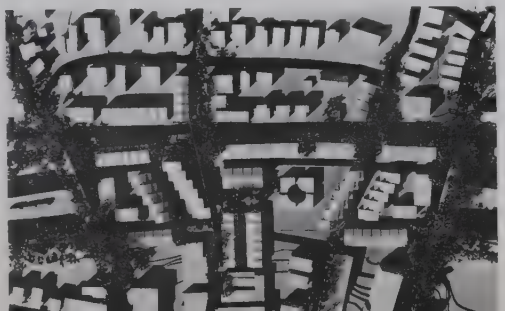
> A depressed road would be a far smaller physical, visual, and psychological barrier to the community. Crossways over the road would be safer, more convenient and pleasant, and could be added in the future as needed. Businesses, schools, and community facilities would be easily accessible from either side of the highway.[1]

However, despite this pressure to accept foregoing assumptions about expressways, it was felt that the extent to which a depressed facility presents less of a "physical, visual, and psychological barrier" to the communities needed more investigation. The findings of this report dispute many of the previously assumed advantages of depressed facilities.

In order to make recommendations based on different impacts of expressway designs, a study was undertaken in Chicago where both types of expressway went through the same area, and where the social and residential characteristics were similar to those in the Southwest Corridor. The width of the corridor is a key factor in determining the differential impacts of the designs. Where there is a narrow roadway, the advantages of a depressed facility are more apparent than when the width approaches 250 feet, as in the case of the Southwest Corridor. The areas in Chicago shared this factor with the Southwest Corridor including the rapid transit facilities in the median. (See Appendix G for a detailed discussion of the findings.)

Distance plays the most important role in determining the severity of highway effects on the people living in neighboring areas. People living adjacent tend not only to be more aware of the roadway and its nuisances, but also are more aware of its advantages. For example, the highest proportion of people who felt their property was worth more since the completion of the expressways lived directly adjacent to them. And at the same time, the highest proportion of people who felt their property was worth less also lived adjacent to the expressways.

The 200 foot wide corridor (above) between Boylston and Mozart/ Atherton Streets would form a strong barrier unless air rights are constructed as pictured below.



1. Impact of the Southwest Expressway on Jamaica Plain, prepared by a working group from the Jamaica Plain Area Planning Council, the Jamaica Plain Community Leadership Center, the Mendell Neighborhood Associates, the Brookside Neighborhood Association, and assisted by Urban Planning Aid, Inc., unpublished, January 1968, p. 1.

Another example of the ambivalence of the residents directly adjacent to the expressways was their response to the question of whether or not people would want to move into their neighborhoods. Approximately the same proportion -- thirty percent -- of those living adjacent as those living three to four blocks away said people would want to move into their neighborhoods.

The most interesting findings concerned the differential impacts of the embanked and depressed designs, especially that the embanked proved to be less of a community barrier than the depressed. When asked if they felt the expressway was a neighborhood boundary or part of the neighborhood, fifty-one percent of those living in the depressed section said the road was a boundary, compared to only thirty-one percent of the embanked sample. This finding was reinforced by the fact that only fourteen percent of the depressed sample ever walk across the expressway compared to twenty-nine percent of the embanked sample.

The extent to which people spontaneously mention the expressway as a neighborhood landmark suggests the extent to which they are aware of it. The relative ease with which people can ignore the embanked is illustrated by the finding that seventy-five percent of the depressed sample mentioned the expressway as a landmark compared to only forty-nine percent of the embanked sample. When asked why people would like to move into their areas, thirty-one percent of the embanked sample cited the ease and convenience of the expressway, compared to only nineteen percent of those living adjacent to the depressed facility.

In one major respect, however, the embanked design generates more negative effects than the depressed. Noise and air pollution were cited twice as often by the embanked sample as negative effects of the roads than the depressed sample, corroborating the findings of noise and air pollution studies cited above. On the other hand, the findings indicate that an embanked roadway has the effect of minimizing the discontinuity imposed by a 250-foot wide expressway.

This can be explained in visual terms by the fact that with the embanked design, the full width of the road is not exposed. To be sure, the viaducts under the facility at cross streets will be apparent. But the ground plane is maintained even at these points and the embankment itself seems like a geographical feature of the area. The exposed section of a depressed roadway, on the other hand, appears more imposing and more of a boundary -- a wide river of traffic severing the communities. For this reason, an embanked expressway might be more appropriate in low density residential areas where air rights are not seen as appropriate.

The landscaped railroad embankment at Green Street appears to be a natural geographical feature.

DEVELOPMENT POTENTIAL

Joint development within and adjacent to the right-of-way will be more important to the future of the study area than the final design of the corridor itself. However, the degree and feasibility of joint development depends strongly on the design, as the above sections of this report indicate. The original embanked and depressed twenty-foot designs offer minimal joint development potential after the corridor is constructed unless costly special design provisions and/or construction techniques are employed. This report recommends that elevated sections in the embanked profile and platforms in the depressed profiles be built at the time of corridor construction to provide for some joint development. However, it is only the depressed ten-foot design that offers the flexibility for future growth over the corridor which can be realized at any time.

The Boston area already has precedents for similtaneous air rights developments over the Massachusetts Turnpike--the Star Market at Newtonville and the Prudential Center in Back Bay. Both of these projects were developed out of unusual circumstances, however. In the case of the Star Market, the arrangements were the solution to the acquisition of an existing supermarket for the Turnpike, and in the case of the Prudential Center, the land was owned by the Prudential Insurance Company which granted an "easement" to the Turnpike Authority. Neither of these special circumstances exists in the Southwest Corridor to guarantee simultaneous joint development.

Since the Massachusetts Turnpike has been constructed, two additional air rights projects have been undertaken. These projects demonstrate the importance of joint development adjacent to, as well as within, the transportation right-of-way. In Newton Corner, a motel/office building/parking garage complex is under construction utilizing both adjacent land and air rights. Near Copley Square, the new air rights parking garage built by the John Hancock Insurance Company will also utilize land adjacent to the right-of-way for exit ramps from the parking levels. In this latter case the water table was low enough so that the boat section could be penetrated without flooding the highway -- unlike the Southwest Corridor if the depressed twenty-foot design were used. In the Newton Corner development, adjacent land was utilized to offset air rights construction costs and thus minimize the proportion of the development actually constructed on air rights.

Joint development over the Massachusetts Turnpike has improved the commercial outlook for Newton Corners.

In addition to conventional air rights construction, three possibilities must not be overlooked. In the future it may be possible to penetrate a boat section because of technological and engineering advances. The second possibility is that foundations for future air rights could be placed at the same time the road is built -- as in Fall River, Massachusetts, where a new civic center will be built some time after the highway is completed. This approach means that the future buildings must be designed prior to road construction so that building loads and footing sizes can be firmly established. The third possibility is the construction of air rights over embanked facilities. This possibility would not have the restrictions of under rights developments but would impose severe problems of construction and traffic control and access. The most likely site for this type of development is in Area 3 where the topography has the effect of depressing the roadway, whatever its profile, in relation to grade. But the chances of this development over the roadway ever being realized are extremely remote.

The commercial area adjacent to Roxbury crossing offers good potential for joint development.

DEVELOPMENT SITES. Within the metropolitan Boston area, locations which have good vehicular and public transportation access are prime sites for development which is oriented towards serving regional needs. There are three such locations within the three-mile segment of the Southwest Corridor under consideration in this report: Roxbury Crossing, Jackson Square, and Forest Hills.

At the northern end of the study area, the land between Roxbury Crossing and Jackson Square in Areas 2, 3, and 4 is adjacent to vehicular access points from the corridor: the proposed Inner Belt interchange and the Jackson Square interchange. These interchanges relate to the cross-city connector streets in the area: Roxbury Street, the future Washington Park Boulevard, Columbus Avenue, and Centre Street. At the southern end of the study area, the land at Forest Hills near the Arborway interchange between Morton Street and Walk Hill Street is also ripe for new development of a regional nature. These vehicular nodes are reinforced by major rapid transit stations at Roxbury Crossing, Jackson Square, and Forest Hills and are considered appropriate locations for large scale development which can relate to the core city within the proposed Inner Belt as well as the industrial and commercial uses along Route 128. Existing commercial nodes along Washington Street, Centre Street, and Columbus Avenue will be reinforced by traffic moving through them to the corridor access points.

Within the Jamaica Plain residential community, joint development should be oriented primarily towards serving local needs with such uses as housing, small scale retail functions, and community oriented educational and service facilities. Three streets which cross the corridor are potential nodes: Mozart/Atherton Street, Boylston Street, and Green Street. These local streets link the existing commercial development on Centre Street and Washington Street. Because the corridor is below the water table (in boat section) south of Green Street to the Arborway Crossing for both depressed designs, Carolina/Williams and McBride Streets are unlikely joint development sites. The rapid transit station at Green Street will be within a ten minute walking distance for most of the Jamaica Plain community and some provision for joint development in both the embanked and the depressed profile designs is recommended.

Joint development over the Southwest Corridor can provide replacement housing and can physically link the two sides of the expressway.

DEVELOPMENT SITES

CROSS CITY CIRCULATION

COMMUNITY CIRCULATION

REGIONAL NODE

COMMUNITY NODE

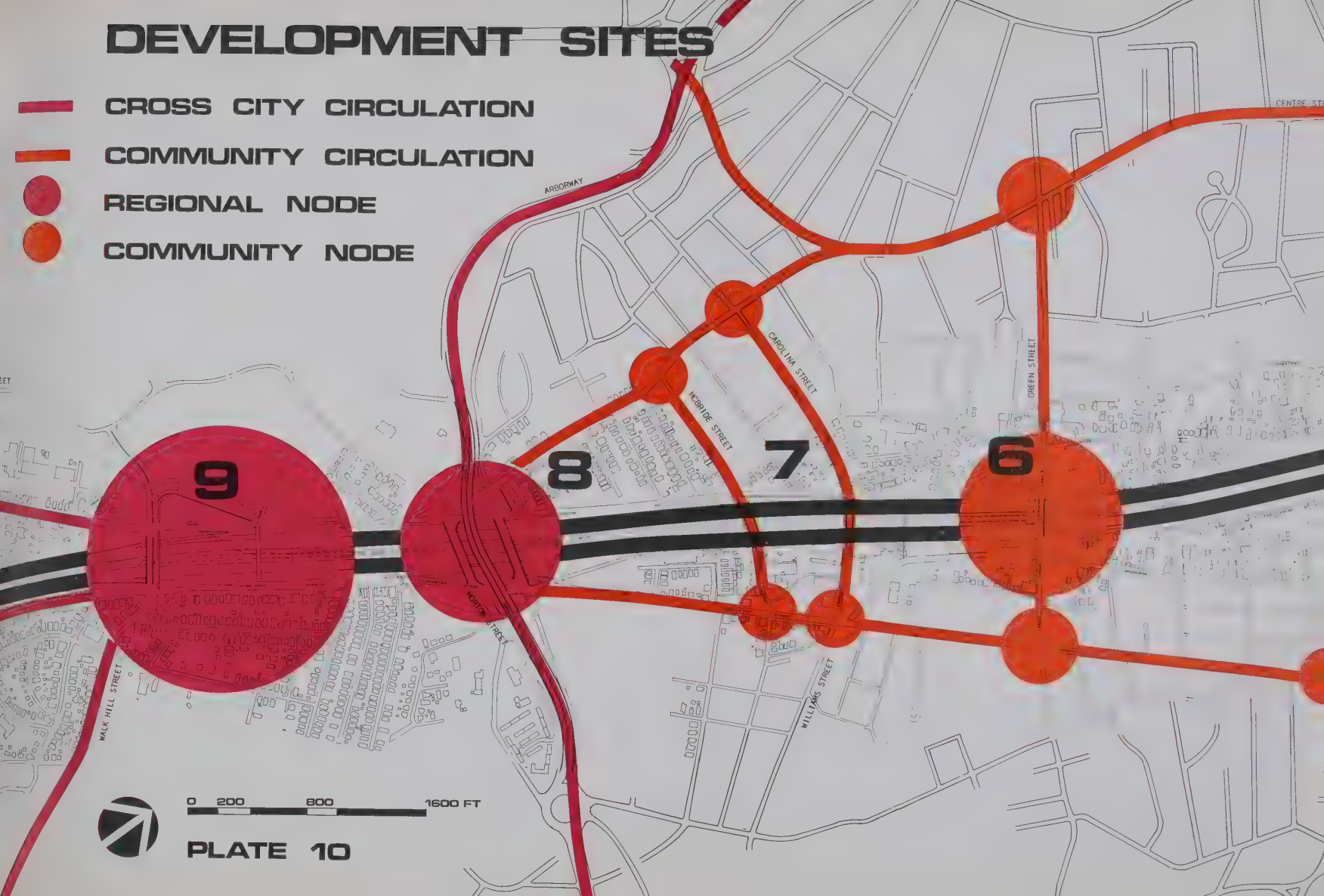


PLATE 10


5
4
3
2
1
HUNTINGTON AVENUE
TREMONT STREET
RUGGLES STREET
HEATH STREET
MYZART STR.
ATHERTON STREET
COLUMBUS AVENUE
WASHINGTON PARK BOULEVARD (future)
ROXBURY STREET (realigned)
WASHINGTON STREET

ARBORWAY INTERCHANGE DEVELOPMENT. The treatment of the Arborway between Franklin Park and the Arnold Arboretum is high on the list of priorities for the development of the Southwest Corridor. This segment of the Arborway is the weakest link in the Olmsted Park plan which was described in the Corridor Analysis section above. In addition to the proposed landscaped air rights development for the spaces between highway connectors and ramps proposed for Area 8 in each scheme, redevelopment of land adjacent to this interchange will strengthen the green link.

The MBTA garages east of the corridor are in sharp land use contrast to the surrounding housing and institutions which are in a park-like setting. When streetcar service is removed from Centre Street, this area can be developed in a way that will be more compatible with the Olmsted concept. Housing is recommended as the most appropriate use for the twelve-acre parcel the MBTA now occupies. Since this parcel is not within the right-of-way, it can be developed according to this proposal regardless of the final corridor design.

The MBTA had originally planned to build new bus garages on this site as soon as the streetcar service is removed from Centre Street and funds for new construction are available, but preliminary discussions with MBTA, BRA, and DPW officials indicate that all parties are receptive to other suggestions on how this parcel can be most intensively and appropriately developed.

Two alternatives deserve consideration at this time. First, new housing could be built as air rights over the new MBTA facilities on their present site. This proposal is attractive to the MBTA since it does not require the acquisition of new land. However, it is highly questionable whether housing and bus garages would be compatible on the same site even if adequate provisions were made for sound insulation and mechanical ventilation.

The second alternative proposes the relocation of the MBTA facilities to some other similar piece of land and their replacement by housing. The site could easily accommodate 600 dwelling units without involving the construction of buildings out of scale with the existing community. This second alternative is favored but would require a good deal of planning and coordination by public agencies and potential private developers. Since this housing could be built regardless of which profile design is selected, it has been shown on Plates 12, 13, and 14.

MBTA bus garages at the Arborway.

It has been suggested that the MBTA could be relocated between the corridor and Washington Street since several of the industrial firms in that area have been displaced by the road and others are considering relocating outside the city. However, the MBTA would certainly need definite assurances concerning appropriate site, financial reparations, and operational feasibility. The benefits to the City of Boston would be great in that combined with the air rights housing discussed below, more and better units would be put back into the housing market than were removed because of the Southwest Corridor land acquisition.

FUTURE DEVELOPMENT IN AREAS ADJACENT TO THE CORRIDOR. Plate 11 illustrates a diagram of prototypical development adjacent to the corridor which could apply to any of the three profile designs since only development within the right-of-way must respond to the specific design of the facility. When residential areas are next to the corridor, it is recommended that new housing combined with landscape materials be used as a buffer for the existing wood frame structures. Although bushes and trees are not the most efficient sound insulator, if used in sufficient quantities and combined with building masses, they will not only offer an attractive visual screen from the road for neighboring residents but will also be a valuable amenity for the community at large.

Although much planning literature suggests that urban highways form a buffer between residential and industrial land use areas, this report recommends that new industrial developments should be designed to protect the community from the adverse effects of the road. Industrial areas should be located adjacent to corridor access points so that trucking and other service-related functions do not invade residential areas. It is further recommended that landscaping separate the industry from the communities so that their residential character is maintained.

PROTOTYPE DEVELOPMENT DIAGRAM

PLATE 11

EMBANKED

Wherever joint development is planned for the embanked design north of the new Forest Hills rapid transit station between Morton Street and Walk Hill Street, the corridor must be elevated to accommodate under rights. Elevated sections are proposed at the following rapid transit station locations: Roxbury Crossing (Area 2), Jackson Square (Area 4), and Green Street (Area 6). Since in all three designs the Walk Hill Street crossing is depressed above the water table, joint development in that area is shown as air rights.

AREA 1 - RUGGLES AND ROXBURY STREETS. Because of the large number of connector ramps at the Inner Belt interchange, development within the right-of-way is extremely unlikely. New development adjacent to the right-of-way in the Madison High School project on the east side of the corridor should include buildings designed to buffer the project from the effects of the road. On the west side, industrial buildings form a buffer for housing on Parker Hill.

AREA 2 - ROXBURY CROSSING. Under rights development in conjunction with the rapid transit station should include commercial facilities compatible with existing retail areas west of the corridor and the Madison High School project east of the corridor. Although under rights limit right-of-way development, the adjacent area has good potential because of its nearness to the Fenway institutional area and Prudential complex.

AREA 3 - PARKER HILL AND FORT HILL. As mentioned in the Corridor Analysis section, the strong land forms in Area 3 suggest an air rights development which could bridge between the two hills regardless of the design of the highway. But because air rights construction over the embanked profile is highly unlikely, this has not been shown in Plate 12.

AREA 4 - JACKSON SQUARE. Because of the new rapid transit station and the proximity of highway access ramps, this area should be developed with regionally-oriented uses such as commercial, business, and parking facilities. Under rights development adjacent to the new rapid transit station should be limited to retail development, but parcels on the east side of the corridor could accommodate large scale office buildings. Lack of existing commercial development and the Bromley-Heath housing project on the west will retard future development. Nonetheless, this area is an attractive alternative for business establishments currently in Egleston and Dudley Squares.

AREA 5 - MOZART/ATHERTON AND BOYLSTON STREETS. The key issue in this area is shielding the wood frame housing from the undesirable effects of the corridor. Since both industrial and residential uses exist in this area, some decision by the city should determine the direction of future development. The diagram of prototypical development illustrated in Plate 11 can serve as a guide no matter which use pattern is favored for future development. However, this would involve extensive redevelopment and would most likely not be accomplished until some years after the corridor is constructed and new use patterns are established.

AREA 6 - GREEN STREET. Under rights development adjacent to the new rapid transit station could provide convenience retail facilities for area residents. As in Area 5, the major issue is protecting the residents from the negative effects of the road. Landscaping can provide a visual shield and the land takings required to realign Lamartine Street provide the area necessary to accomplish this.

AREA 7 - CAROLINA/WILLIAMS AND MCBRIDE STREETS. With industry on the east side of the corridor and housing on the west, Area 7 most closely approximates the prototype development diagram shown in Plate 11. Industrial uses are particularly appropriate on the east side of the corridor and higher density housing on the west because of the proximity of the Arborway interchange which offers good regional access.

AREA 8 - ARBORWAY INTERCHANGE. Because of the complexity of the interchange with roadways and connector ramps at three different levels, no development within the right-of-way is considered feasible. Since this area is the weakest link in the Olmsted Park Plan discussed above, it is recommended that special attention be given to landscaping in order to reinforce the link between Franklin Park and the Arnold Arboretum. Adjacent development involving the current MBTA land shown as housing is discussed above.

AREA 9 - WALK HILL STREET. At this point all designs for the Southwest Corridor are depressed but remain above the water table. Consequently, an air rights development is feasible here. A regional shopping facility could be built on land taken for the interchange and the West Roxbury MBTA branch. A large parking facility should be built to accommodate shoppers and transit patrons using the new Forest Hills station. The new Vocational High School proposed for the west side of the corridor will further increase the development potential of the area.

EMBANKED
PROPOSED SITES

PLATE 12

DEPRESSED 20 FOOT

Because the depressed twenty-foot design is below the water table, joint development projects will be economically feasible only at the time the corridor is constructed and must be an integral part of the highway plans themselves. Air rights developments have been shown in Plate 13 at rapid transit stations (where there will be a market to support the new facilities as soon as the corridor is opened), at cross streets adjacent to residential areas (to provide replacement housing and to reintegrate the community), and at the Arborway interchange (to maintain the continuity of open space between the Arboretum and Franklin Park). It is strongly emphasized that expansion of these facilities over the corridor is unlikely because of the difficulty of penetrating the boat section construction.

AREA 1 - RUGGLES AND ROXBURY STREETS. As in the embanked scheme, the large number of connector ramps at the Inner Belt interchange will make development within the right-of-way very difficult. Buildings adjacent to the road in the Madison High School project should be designed as a buffer against the highway. The industrial areas on the west side of the corridor serve the same function.

AREA 2 - ROXBURY CROSSING. Air rights development at the rapid transit station has been recommended to provide commercial services to rapid transit patrons, local residents, and motorists. Additional development within the right-of-way could relate to the institutional area at the Fenway and related facilities planned in conjunction with the high school project. Because this area is close to the central business district and is adjacent to a major highway interchange, it offers an excellent opportunity for hotel and entertainment uses.

AREA 3 - PARKER HILL AND FORT HILL. The strong land forms in Area 3 suggest a man-made bridge built as air rights development between the two hills over the corridor, but unless firm proposals are generated before the corridor is constructed, this excellent opportunity will be lost.

AREA 4 - JACKSON SQUARE. An air rights platform should be built in connection with the rapid transit station. This area is a prime site for new development due to the large amount of city and state owned land on the east of the corridor. Impetus for new development could be gained from a large scale air rights project containing rentable office space, commercial, and parking facilities. The area will also be attractive to businesses presently located in Egleston and Dudley Squares.

AREA 5 - MOZART/ATHERTON AND BOYLSTON STREETS. At this location, 200 low rise housing units are proposed on air rights to be built at the time of corridor construction. The project will help to provide replacement housing for Jamaica Plain residents displaced by the road and will also provide visual and physical continuity between the two sides of the corridor. Future development in areas adjacent to the corridor where air rights do not exist should be developed in a similar fashion to the prototypical illustration in Plate 11.

AREA 6 - GREEN STREET. A medium rise apartment building with 200 dwelling units is proposed as air rights to be built at the same time as the corridor. The rapid transit station will be an attractive convenience for persons occupying the project while the platform itself serves the surrounding neighborhood with retail and community facilities. New housing adjacent to the highway should involve development similar to that suggested in Plate 11.

AREA 7 - CAROLINA/WILLIAMS AND MCBRIDE STREETS. Again, the existence of the boat section would prohibit air rights development at this location. The industrial area on the east side of the corridor will form a good buffer against the noise and exhaust fumes of the road but on the west side a new housing development with dense landscape materials is suggested as a way to limit the adverse effects of the expressway on the existing residential community.

AREA 8 - ARBORWAY INTERCHANGE. Any air rights facility requiring a high volume of direct automobile and pedestrian access would not be successful at this location due to the large number of connector ramps. The interchange does present an opportunity to reinforce Olmsted's Park Plan to link Franklin Park and the Arnold Arboretum. This report recommends that a landscaped platform be built here concurrently with the corridor construction. New housing at the site of the existing MBTA yards is shown to maintain the continuity of green space and has been discussed above.

AREA 9 - WALK HILL STREET. As in the embanked profile, the Southwest Corridor is depressed in this area but remains above the ground water table. A large scale regional shopping facility is recommended for this location with parking facilities to accommodate rapid transit patrons and shoppers using the new Forest Hills station. The new vocational high school proposed for the west side of the corridor will increase the development potential of the area.

DEPRESSED 20 FOOT
PROPOSED SITES

PLATE 13

DEPRESSED 10 FOOT

Because the depressed ten-foot design is above the water table throughout most of its length, air rights development can be built at any time during or after the construction of the corridor. However, this report recommends that air rights housing in Areas 5 and 6 and a landscaped platform in Area 8 be built when the corridor is constructed. The most extensive joint development would most likely appear at places where motorists and transit patrons have access to the corridor, but there are opportunities for additional development at any location along the corridor where the demand might exist.

AREA 1 - RUGGLES AND ROXBURY STREETS. As in the embanked and the depressed twenty-foot schemes, the large number of connector ramps at the interchange makes development within the right-of-way extremely unlikely. Although noise and air pollution are less of a problem than with the embanked design, buildings adjacent to the road in the Madison High School project should be designed as a buffer. The industrial areas on the west side of the corridor perform the same function.

AREA 2 - ROXBURY CROSSING. The proximity of the institutions in the North Fenway and Huntington Avenue areas as well as the nearness of the Prudential Center make Roxbury Crossing a prime location for development. A hotel or motel complex would be an appropriate use because of the good highway and mass transit facilities while rentable office space and retail could also be successful. Large parking garages should be provided to encourage motorists to use the rapid transit facilities.

Model of air rights housing proposed for Area 5.

AREA 3 - PARKER HILL AND FORT HILL. The topography in this area suggests air rights development which would form a man-made bridge across the corridor. In this scheme an air rights complex is most feasible and therefore has been shown in the joint development drawing. A large number of uses which do not require direct regional access are possible at this location, such as a community college, subsidized low and moderate income housing, and facilities supporting nearby medical and educational institutions.

AREA 4 - JACKSON SQUARE. This area can serve as the focal point of new development along the corridor since it is served by a major rapid transit station and is a regional access point for vehicular traffic. Development in Jackson Square should be multi-purpose and large scale. High rise office towers over the corridor would be in an excellent location for businesses oriented toward center city as well as metropolitan markets. Parking and commercial facilities at lower levels would serve commuters, office workers, and pedestrians.

Although the Bromley-Heath housing project will limit growth on the west side of the corridor, ultimate land appreciation may lead to future new development. Large parcels of state and city owned land on the east side of the corridor would be available for the extension of the new development. This area will also be attractive to business establishments currently located in Egleston and Dudley Squares when the rapid transit is relocated from Washington Street onto the corridor.

AREA 5 - MOZART/ATHERTON AND BOYLSTON STREETS. Air rights development in this area is designed to provide 200 units of low and moderate income housing with some community facilities constructed concurrently with the corridor. The main advantage would be the replacement of housing units required for construction of the corridor. Additional advantages include the reintegration of the Jamaica Plain community over the corridor, the virtual elimination of the highway for residents adjacent to air rights construction, and the maintenance of the residential character of the neighborhood. This latter quality can be strengthened by limiting the height of the new development so as to be in scale with the existing dwelling units. In areas where there are no air rights projects, noise and pollution from the corridor can be reduced by new development as illustrated in Plate 11. The residential character of the neighborhood could be further strengthened if the existing industrial activities within the area were zoned as nonconforming uses.

DEPRESSED 10 FOOT
PROPOSED SITES

PLATE 14

AREA 6 - GREEN STREET. The rapid transit station suggests more intense air rights development here than in Area 5. Retail facilities adjacent to the MBTA station lobby are suggested along with a medium rise apartment building with 200 dwelling units. This report recommends that this development be built simultaneously with the highway. Community facilities should make use of the playground at Green Street and it has been suggested by members of the community that an elementary school could link the two sides of the corridor. Housing areas not adjacent to air rights should be developed to act as a buffer against the noise of the highway.

AREA 7 - CAROLINA/WILLIAMS AND MCBRIDE STREETS. Although the proximity of the Arborway interchange makes this area attractive to industry, care should be taken that industrial development remains within the area bounded by the corridor and Washington Street. In this location industry would serve as a buffer between the corridor and existing residences. However, new industrial development in the area should be required to have a minimum setback so that landscape materials would serve as a buffer between it and the residential community as proposed in Plate 11. The treatment of the west side of the corridor should follow this prototypical diagram, emphasizing redevelopment to reduce the negative effects of the road on the adjacent residents.

AREA 8 - ARBORWAY INTERCHANGE. Land within the right-of-way is fragmented by the connector roads of the interchange. Because of this and the difficult access problems, development should be landscaped open space. This will reinforce Olmsted's Park Plan and link the Arnold Arboretum with Franklin Park. Because of the complexity of the corridor structures, it is recommended that the platform be built at the same time as the road. This proposal presents an opportunity for local government to enhance the environment and improve the quality of its existing parkland space. Housing at the site of the existing MBTA yards would maintain the continuity of green space discussed above.

AREA 9 - WALK HILL STREET. As in the embanked and depressed twenty-foot profiles, the Southwest Corridor is depressed in this area but remains above the ground water table. A large scale regional shopping facility is appropriate at this location because of the large amount of available land due to the extensive takings required for the interchange and the West Roxbury branch of the MBTA. A large parking facility should be built to accommodate rapid transit patrons and shoppers using the new Forest Hills station. The new Vocational High School proposed for the west side of the corridor will increase the development potential of the area since more than 5,000 students will pass through the area each day.

RECOMMENDATIONS

GENERAL

Improved accessibility and its related effects are the most important long range factors in the construction of the corridor. The increased desirability of local properties will probably lead to significant changes in land value and rent levels and the adjacent land will tend to take on progressively more regional uses. In the long run this is likely to stimulate the economy of the area.

IT IS RECOMMENDED THAT EVERY EFFORT BE MADE TO REINFORCE THE EXISTING RESIDENTIAL CHARACTER OF THE ADJACENT COMMUNITIES. This involves the replacement of the housing and community services that have been removed by the construction of the highway, and rebuilding the residential areas which will be most affected by the noise and air pollution from the highway. In order to accommodate the low and moderate income population of the present communities, it will be necessary here, as it is everywhere, to subsidize the construction of new low income housing. The reinforcement of the existing residential communities will also require the construction of joint development projects spanning the right-of-way.

To further offset disruption to the communities, new regionally-oriented industrial, commercial, and institutional uses should be limited to those areas of the corridor adjacent to the expressway and rapid transit access points. In the remainder of the corridor, community-oriented recreational, institutional, and commercial development should be encouraged in order to shield the residential areas from expressway disturbances.

IT IS RECOMMENDED THAT RESIDENTIAL DEMONSTRATION PROJECTS BE BUILT AS PART OF HIGHWAY CONSTRUCTION AS AIR RIGHTS AT GREEN STREET AND BETWEEN BOYLSTON AND MOZART/ATHERTON STREETS. Because of the important role played by air rights development in unifying neighborhoods along the corridor, physical planning and architectural expression should encourage use by the existing communities. To accomplish this, it is recommended that local residents participate in the planning and design of the community-oriented air rights projects. Housing built as air rights over an embanked expressway would not be compatible with the existing character of the neighborhood and would present extreme difficulties in architectural design, construction, and user access.

IT IS RECOMMENDED THAT A LANDSCAPED OPEN SPACE PLATFORM BE BUILT AS PART OF HIGHWAY CONSTRUCTION AT THE ARBORWAY INTERCHANGE. The opportunity exists with the building of the corridor to make the Olmsted linear park system once more continuous at this point. It is important both that pedestrian movement across the corridor be facilitated and that landscaped recreational uses rejoin these parts of Boston's historic park system.

IT IS RECOMMENDED THAT DEFINITE OPPORTUNITIES BE PROVIDED FOR JOINT DEVELOPMENT FOR COMMERCIAL ACTIVITIES AT CORRIDOR ACCESS POINTS. It will be necessary either to build platforms as part of the highway construction, or to make possible the building of platforms at a later date in order that the economic development of the communities can take place efficiently and effectively around their natural foci -- the rapid transit stations and the expressway access points.

PROFILE

IT IS STRONGLY RECOMMENDED THAT THE DEPRESSED TEN-FOOT PROFILE BE SELECTED FOR CONSTRUCTION IN THIS SEGMENT OF THE SOUTHWEST CORRIDOR. With this design, lower costs are incurred because of construction above the water table, only three platforms need be built at the time of highway construction, and any amount of air rights development can take place after highway construction.

With the depressed twenty-foot profile it is not economically feasible to construct air rights after completion of the expressway. Thus, the added difference in highway construction costs for the boat section, the larger number of platforms to be built at the time of corridor construction, and the inability to build air rights in the future all combine to make this design a more costly and limiting solution. Although the embanked profile

is least expensive to construct, it does not offer good joint development potential. Near the urban core where land will increase in value and intensity of use, it would be short-sighted not to provide for the future development of areas within transportation right-of-ways. Under rights provide joint development possibilities but are limited in flexibility of use and expansion potential.

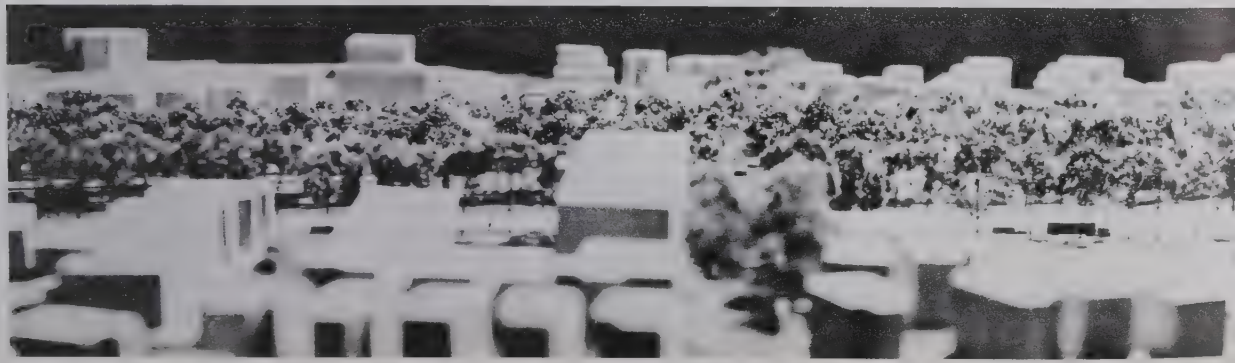
This study has shown that the potential for air rights development is the most important environmental factor distinguishing the three profiles. Air rights development which is compatible with the adjacent areas over a depressed highway will eliminate most noise and air pollution problems for adjacent properties, will physically and psychologically bridge over the river of traffic and will replace building space that has been taken from the community and the city tax rolls.

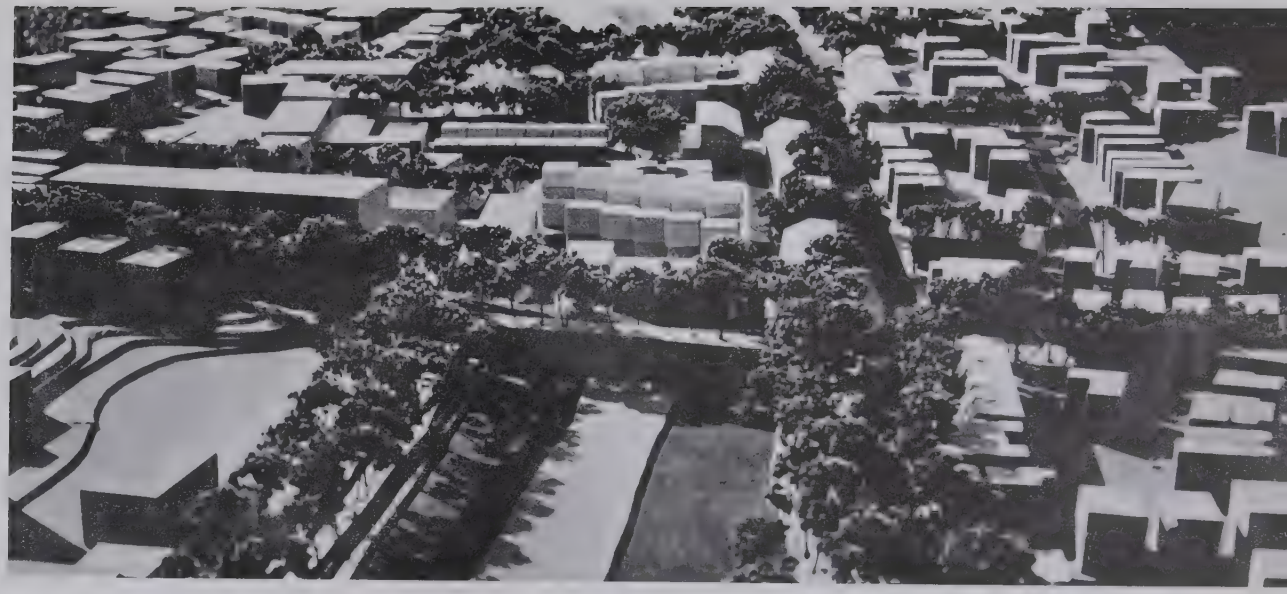
FOR THE DEVELOPMENT OF AIR RIGHTS SPACE AFTER EXPRESSWAY CONSTRUCTION, IT IS RECOMMENDED THAT THE CITY AND THE STATE PARTICIPATE FINANCIALLY WITH THE DEVELOPER. The use of the economic model developed for this project (see Appendix A) will allow the city to predict more accurately the financial costs and benefits of alternative projects, and to weigh these against the social and environmental consequences of the development. The model analyzes the economic feasibility of air rights platforms leased by the city to developers and plots the flow of income and expenditures over time. The model indicates that under certain conditions, the increase in municipal tax income alone justifies the construction of the air rights platforms by the city. The tax revenue for air rights projects, the increased tax revenues from land adjacent to air rights development, and the ability of the city to issue tax-exempt bonds, combine to make the municipal government the logical choice for financing the construction of the platforms.

Because the greatest potential for the joint development of air rights will not occur or be realized immediately, and because several years are often necessary for the coordination of financial and legal aspects and the preparation of plans, it is possible that no air rights projects will be ready for construction except those which are designed as an integral part of the project.

Although the depressed ten-foot profile is strongly recommended, the possibility exists that one of the other profiles will be selected. If this proves to be the case, it is recommended provisions be made for future joint development opportunities at appropriate locations. For the embanked design, it is recommended that the highway should not be constructed unless elevated sections are built to allow for future under rights developments at corridor access points. For the depressed twenty-foot design, it is recommended that the highway not be built unless platforms for housing at Green Street and between Boylston and Mozart/Atherton Streets, and an open space recreational platform at the Arborway crossing, and platforms suitable for commercial development at the access points are built as part of the highway construction.

View of the depressed ten-foot design from Atherton Street in Area 5.





Air rights housing development proposed for future development over the expressway. The platform is recommended to be built with the highway.

IMPLEMENTATION

It is beyond the scope of this analysis to plan the implementation of the recommendations for corridor and community developments. However, the following discussion will serve as an outline for the detailed planning of implementation.

CORRIDOR OWNERSHIP. The joint development of corridor space during any phase of construction or operation will be greatly facilitated by the single ownership of the corridor right-of-way. This would be possible if the State of Massachusetts,

instead of selling the rapid transit corridor in fee simple to the MBTA, would sell the MBTA a permanent easement that would include a height limitation. In this way, the right-of-way joint development rights would be controlled by a single agency, thus greatly simplifying negotiations with potential public and private developers.

FINANCIAL ANALYSIS. The economic model described in Appendix A should be refined with the aid of the city tax bureau and other interested agencies to apply specifically to the Southwest Corridor area. Potential private developers should then be contacted and presented with a range of feasible air rights projects, specific locations, and financial arrangements. The city would be able to aid joint development in this way only if it obtained control of the air rights from the DPW.

ZONING. A change in the existing zoning for the corridor area is necessary to limit regionally-oriented uses to corridor access points and to encourage community-oriented recreational, institutional, and commercial development. Zoning which will permit higher density residential development is necessary, especially in areas where new development is anticipated around corridor access points. These zoning changes must be carried out by the city government independently of expressway approval or construction. However, they are an indispensable prerequisite for balanced community and corridor development and should be accomplished before construction is begun.

CONSTRUCTION. The Southwest Corridor construction will include the recommended provision for joint development which is essential to maintain and improve the environmental quality and the economic life of the adjacent communities. For the recommended depressed ten-foot profile, this involves building three platforms for community housing and open space as part of highway construction. In order to demonstrate the economic feasibility of residential air rights development as well as to replace existing housing it has been recommended that the residential areas at Green Street and between Boylston and Mozart/Atherton Streets be developed as demonstration projects. These two projects are the most important for community development within Jamaica Plain and they represent two distinct types of air rights residential construction. Funds for this might be granted by either the Department of Transportation or the Department of Housing and Urban Development, or both.

The open space platform at the Arborway crossing would also be built at the same time as the corridor. The park and recreation areas on the platform could be planned and funded by the state.

The air rights development of low and moderate income housing built after the expressway is completed will require government subsidies as well. For high density developments, it is likely that the more generous of the federal below-market interest rate subsidies will be sufficient and should be utilized fully for replacement housing. For lower density developments of the type illustrated in the accompanying photograph, an additional subsidy will be required to cover costs of platform construction. It is suggested that this subsidy is a replacement in kind of the developable land removed by the construction of the highway. This justifies subsidizing the cost of the platforms by the federal government at the same rate that the construction of the highway is subsidized.

A further opportunity for building replacement housing exists at the site of the present MBTA Arborway yard. This site is well located for residential development and if designed with well landscaped and adequate open space could replace the continuity of the Olmsted linear park system. This could be accomplished by building housing above the proposed bus garage or adjacent to it on the same site. However, a more satisfactory and less costly solution would involve building the proposed MBTA facilities on a new site between Washington Street and the corridor. This site is soon to be vacated by Gulf Oil Company and other industrial users. In this location, the MBTA facilities would also serve as a buffer between the expressway and the residential areas to the east.

The rebuilding of the adjacent residential areas which will be most affected by noise and air pollution from the highway can best be accomplished with the help of a government agency which would assemble land in tracts large enough to be attractive to private developers. For low and moderate income families, it is felt that the standard below-market interest rate subsidies will be adequate for most of the developments.

Eventual expansion of any of the public or private air rights developments into adjacent air rights space is only feasible over the depressed ten-foot roadway. The potential for this sort of expansion may be an important part of the attractiveness of air rights development to commercial and institutional users. To realize the potential for this expansion the air rights developer should be given an option on adjacent air rights space.

APPENDICES

APPENDIX A

AIR RIGHTS ECONOMIC MODEL

One of the recommendations made is that the air space most appropriate for commercial development should be given for a nominal amount to the municipality. We further recommend that the latter contract with business firms for the use of the air space, construct the necessary platform (or otherwise finance the incremental cost of building over the corridor) and lease the platform to the private parties involved. In so doing, the municipality has two advantages: 1) the capacity to issue tax-exempt bonds, and 2) the ability to calculate in its return-on-investment the incremental tax revenues from adjacent properties whose value has increased by reason of the platform development. Given these advantages, the municipality should be able to lease a platform at a rate below that for which a private internal profit-seeking enterprise could provide its own. Therefore, a private enterprise using the platform should be able to accept a lower level of anticipated earnings. If this be the case, a municipal construction (or financing) of the platforms should speed up the rate of platform development - and, hence, shorten the length of time before which the municipality may expect to receive incremental tax revenue both from the platform development and from increased value of adjacent property generated by the platform development.

For a purely economic study, we posed the problem and its solution as follows.

1. Problem: Under what conditions would it make economic sense for the municipality to build and lease platforms?

2. Restated: Under what conditions does the expected flow of incremental tax and rental income (less anticipated financial charge), spread out over time, produce a present discounted value that is positive?

3. Assumptions:

   (a) Air rights are given to the municipality, or leased to it, for a nominal value.

   (b) The platform is not constructed until someone has contracted to build a structure on it as soon as the platform is delivered.

   (c) A platform surface area of 200,000 square feet is assumed to be large enough so as to minimize per-square-foot construction cost, to be of reasonable size, and to provide some feel of community continuity.

   (d) Maintenance of the platform by the entity to which it is leased, from the time it is delivered to the lessee.

   (e) From the point of view of the entity building on the platform, the site is of no greater value than that of adjacent land.

   (f) Annual rental income of platform can be related (as a percentage) to the assessed value of the adjacent land.

   (g) Annual tax revenue can be related (as a percentage) to the cost of the building constructed on the platform. (If tax is assessed on income, which is, in turn, a percentage of the investment in the building, the problem remains the same.)

   (h) No tax is levied on a building constructed on a platform until the building is completed.

   (i) Platform rental is not collected until the platform is completed.

   (j) Platform construction requires one to two years; building a structure on the platform requires an additional one to two years.

   (k) The bonds issued by the municipality equal the cost of the platform and are repaid in year x.

   (l) The range of values shown below for each variable include all reasonable values.

4. The general equation:

$$NPV = \frac{\left[r(L) + t(B) - f\frac{(B)}{2}\right]}{1+i} + \frac{\left[r(L) + t(B) - f(P)_2\right]}{(1+i)^2}$$

(First Year) (Second Year)

(year x) (year n)

$$\frac{\left[r(L) + t(B) - P_x\right]}{(1+i)^x} \qquad \frac{\left[r(L) + t(B)_n\right]}{(1+i)^n}$$

In which:

NPV = net present value of anticipated flow of net income in the future (aggregated by year)

r = annual rent as a percentage of assessed land value

L = assessed psf value of adjacent land x platform area of 200,000 square feet

t = annual tax as a percentage of construction costs of a building

B = cost of building constructed on the platform

f = financial charge as a percentage of platform construction cost

P = cost of platform construction (200,000 sq. ft.)

i = relevant interest rate for discount-purposes

x = year in which bonds mature

n = 100th year or last year producing an NPV greater than $100, whichever comes first.

That is:

r(L) = annual rental income of platform (equals zero for first year or two)

t(B) = annual tax revenue from building constructed on platform (equals zero for first two to four years)

f(P) = annual financial charges (in year one, only one-half would be paid. In year x, the bonds mature, and thereafter to year n this expression equals zero).

5. Reasonable Range of Values for Each Variable:

r (rental)	2%	to	20%
L (land value of platform)	$400,000 ($2 psf)	to	$2,000,000 ($10 psf)
t (tax rate)	1%	to	6%
B (building cost)	$2,000,000	to	$15,000,000
f (financial charge)	4%	to	8%
P (platform cost)	$5,000,000 ($25 psf)	to	$8,000,000 ($40 psf)
i (discount rate)	6%	to	10%
x (maturity of bonds)	10 yrs	to	20 yrs
Platform construction time	1 yr	to	2 yrs
Building construction time	1 yr	to	2 yrs

6. We used three sets of variables: (A) most favorable to the city, (B) "most reasonable", and (C) least favorable to the city.

	(A) Most Favorable	(B) "Most Reasonable"	(C) Least Favorable
r	20%	5%	2%
L	$4,000,000 ($10 psf)	$1,200,000 ($6 psf)	$400,000 ($2 psf)
t	4%	3%	1%
B	$15,000,000	$6,000,000	$2,000,000
f	4%	6%	8%
P	$5,000,000	$7,000,000	$8,000,000
i	6%	6%	10%
x	20 yrs	15 yrs	20 yrs
P*	1 yr	1 yr	2 yrs
B**	1 yr	1 yr	2 yrs

* construction time
** construction time

7. Solutions:

In the least favorable case, the NPV = a minus $6,542,168.

In the most reasonable case, the NPV = a minus $3,200,311.

In the most favorable case, the NPV = a plus $11,381,542.

(In all three cases, additions to NPV fall below $100 in some year after year 100, but computations stopped at year 100 in each case.)

Bear in mind that this solution does not take into consideration any incremental tax revenue from the adjacent land.

8. An Alternative Solution:

Assume that the platform construction cost is cut from a minimum of $25 psf to $16 psf (thus, L = $3,200,000) by an urban renewal subsidy equal to roughly one-third.

Assume further that a low-cost housing block cost on $6,000,000 (thus, B = $6,000,000) is constructed on the platform, which is taxable. All other variables approximate their "most reasonable" values.

In this case, the NPV = a plus $492,132. (Additions to NPV fall below $100 some time after year 100).

(a) The above means that a platform cost of about $3.4 million ($17 psf) carrying a building valued at $6 million represents an approximate break-even point. This implies a subsidy of $9 psf, or $1,600,000 for the platform.

(b) If the building value were reduced to $3,000,000, the platform cost would have to be nearly 100% subsidized in order for the project to break even in financial terms. This implies a subsidy of about $5,000,000 for the platform.

In neither case is an incremental tax income from adjacent land included in the calculation.

9. A Further Solution:

Thus far, we have not built into our model any incremental tax income arising by reason of the increase in taxable value of the adjacent land. We can do this by redefining "B" as being equal to the tax value of the building plus the increase in the taxable value of adjacent land by reason of the platform development. Assuming that present land value ranges from $2 to $10 psf, a reasonable range for the

incremental value would be from about $4 to $10 (i.e., total augmented values range from $6 to $20), the "most reasonable" being $6.

Let us assume further that an adjacent area four times the size of the platform (i.e., 800,000 sq. ft.) is so affected, surely a conservative assumption.

Therefore, our new value of "B" ranges from $5.2 million in the least favorable case (i.e., $2,000,000 + $3,200,000), to $23 million (i.e., $15,000,000 + $8,000,000) in the most favorable, with a "most reasonable" value being $10.8 million (i.e., $6,000,000 + $4,800,000). Using values indicated above for the other variables, we find that:

(a) In the most favorable case (B = $23 million), NPV = plus $16,112,698. Additions to PDV drop to less than $100 some time after year 100.

(b) In the most reasonable case (B= $10,800,000), NPV = minus $1,071,408. Addition to PDV drops to less than $100 some time after year 68.

(c) In the least favorable case (B= $4,400,000), NPV = minus $6,305,601. Addition to PDV drops to less than $100 some time in year 100.

Therefore, in order to generate an attractive financial proposition from the point of view of the city, one would have to assume an incremental tax base on adjacent land something in excess of $6 psf over 800,000 square feet, or a somewhat larger area, or shift one of the other variables -- say, increase the value of the building to $8 or $9 million.

10. Finally, we tested the model to ascertain the sensitivity of the outcomes to each of the variables. To do so, we shifted the value of the variable being tested and held the values of the others constant at their "most reasonable" levels.

The outcomes in NPV in each case were:

Variable Tested	With Most Favorable Value	With Most Reasonable Value	With Least Favorable Value
r (rental)	- $378,977	- $3,200,311	- $3,764,579
L (land value)	- 2,573,345	- 3,200,311	- 3,827,277
t (tax rate)	- 2,313,277	- 3,200,311	- 4,974,389
B (bldg. cost)	+ 791,409	- 3,200,311	- 4,924,389
f (finan. chg.)	- 4,493,978	- 3,200,311	- 1,906,659
P (platform cost)	- 1,256,926	- 3,200,311	- 4,172,013
i (discount rate)	- 3,200,311	- 3,200,311*	- 2,647,315
x (maturity date)	- 3,200,310	- 3,200,311	- 3,200,330
P construction time	- 3,200,311	- 3,200,311*	- 3,404,843
B construction time	- 3,200,311	- 3,200,311	- 3,351,443

*Most favorable and most reasonable values are the same; thus, the outcomes are the same.

These outcomes are derived from the basic model, i.e., with no consideration of incremental tax revenues from adjacent land.

It will be noted that in using the most reasonable values for all variables other than the one being tested, only one variable set at its most favorable value produces a positive NPV, i.e., building cost. The most favorable rental rate came close to producing a positive NPV, though still $378,977 short.

It will be further noted that maturity date of the bonds and the construction time of platform and building make only a limited impact on NPV.

Richard Robinson
Sloan School of Management, MIT

APPENDIX B

AIR RIGHTS DEVELOPMENT

Although this report is being prepared for a special project, many items contained therein will be applicable to air rights developments in general. Air rights basically are not new, but rather, have been modernized to coincide with the modern methods of transportation. Use of air rights was made in Italy with shops occupying the bridges over the canals. In New York City, air rights were developed on Park Avenue over the railroad right-of-way.

The basic purpose of air rights development today is to put back on the tax rolls that which was removed by the rights-of-way for modern expressways and rapid transit lines. As an example of this it is estimated that the two air rights projects in the City of Newton, when completed, will place on the tax rolls of said City an assessed valuation approximately three times greater than the valuation removed by the acquisition of property for the right of way for the Boston Extension. An air rights development is not an easy project and takes a great length of time. There must be detailed cooperation of the engineers, attorneys, real estate officials and financial people representing both groups involved. Each project must be considered on its own individual merits because of variations in soil conditions, locations, traffic patterns, and the like. The type of right-of-way involved in connection with the project is of great importance. Different types of developments are as follows:

1. Over high speed operating toll highways
2. Over high speed operating freeways
3. Over railroad rights-of-way
   a. Electric powered equipment
   b. Diesel powered equipment
4. Over rapid transit rights-of-way and yards
5. Over parking lots
6. Air Tunnels over railroad rights-of-way

There are instances where the area under a viaduct or elevated highway is referred to as air rights. It is my belief that such an area should be considered as a ground area with a limited elevation that is available or could be made available for development.

The laws which authorize the development of air rights should be carefully examined from the viewpoint of exemption from local codes, zoning, and building laws. The Massachusetts Turnpike Authority has a special law for air rights development. This law makes applicable the National Building Code instead of the Boston Building Code and makes the Authority exempt from the Boston zoning. All of the laws and codes of the City of Newton and Town of Brookline are applicable. The structures are subject to taxation but not the land as the land was acquired for public purposes and is owned by an agency of the Commonwealth of Massachusetts. The Department of Public Works of the Commonwealth of Massachusetts is authorized by law to develop air rights under the local laws and codes. The Bureau of Public Roads authorized the development of air rights over Federally financed expressways under established complicated procedures. To the best of my knowledge, no other agencies have laws authorizing the development of air rights. The Massachusetts Bay Transportation Authority has filed for legislation to authorize air rights development.

The important aspect of the laws is that private property cannot be acquired by eminent domain for air rights development. Rather, remainders have to be joined with the air space over the right-of-way in order to make an air rights project possible. As most developments involve rights-of-way of agencies of the State Government, local Redevelopment Authorities can negotiate only for a development that involves property in excess of the right-of-way. The power of eminent domain cannot be employed as the local Redevelopment Authority is subservient to the State Agency. This is an important factor as will be indicated later.

The Star Market was built as air rights during the construction of the Massachusetts Turnpike in Newton, Massachusetts.

Pilings for the new John Hancock Garage which, like the Prudential Center in the background, will utilize air rights over the Massachusetts Turnpike in Boston.

The procedure for inviting or securing the development of air rights is difficult as the laws of the Commonwealth require bidding. Nobody knows the desires of a developer or what his proposal will be. Therefore, how can specifications be prepared for bidding? The agency seeking the development cannot dictate the project in many respects. In my opinion, there is great danger in seeking bids as control is lost. Control is essential. It is my belief that the screening of proposals requested is more beneficial. By this method the sound developer is determined as compared to the operator who is seeking to get control and then broker the various aspects. The beneficial aspects of air rights are that this relocation of commercial and residential occupants is eliminated and initial large capital expenditures are not required. As most of such developments are located in urban areas where land is scarce and costly, the latter aspect is of great importance.

Long-term leases are essential for financing purposes. To this point generalities have been given consideration. It now seems essential to delve into the specifics and procedures involved in reaching a finalized lease.

There is no doubt but that the ideal situation is to construct the footings, columns, and slab during the construction of the rapid transit line, the expressway, or the toll facility and collect the cost thereof over a period of time. However, how can this be done when the proposed projects and details are unknown? The air rights are secondary to the main project, which cannot be delayed. The study that you are making could, in certain specific proposals, involve as many as four ownerships. You have advised me that on the Southwest Corridor, the Commonwealth of Massachusetts, Department of Public Works proposes to give or sell to the Massachusetts Bay Transportation Authority that portion of the right-of-way that the rapid transit lines will occupy. Incidentally, the portion to be occupied is located between the expressway lanes. I would not recommend this procedure but rather would recommend the granting of a permanent easement which would define the purpose, use, reservations, and elevations. By adopting this procedure, the entire right-of-way would be under one fee ownership. This is the status of the Boston Extension of the Massachusetts Turnpike and the Penn-Central Railroad Company.

I have also been advised that to depress the highway and rapid transit lines and maintain satisfactory grades for the local public ways, it will be necessary to establish an elevation ten feet below the existing water table. This poses a very serious problem and was one encountered by the Massachusetts Turnpike Authority in leasing air rights between Clarendon Street and Dartmouth Street in Boston, Massachusetts. From Huntington Avenue to Kneeland Street, near the South Station, the Boston Extension of the Massachusetts Turnpike is constructed as a boat section. The water table cannot be lowered as great damage could and probably would be caused to structures such as the Boston Public Library and the famous churches located around Copley Square. These structures are built on piles which would dry out if the water table was lowered. The elevations were such between Dartmouth Street and Clarendon Street that the water was just below the top of the caissons that were driven about one hundred and twenty feet to rock in the median strip. In this instance, it was possible to pierce the seal of the boat section without flooding the travelled way. However, further east from this section, the elevations are such that it would not be possible to pierce the seal of the boat section without flooding the travelled way.

When negotiating the basing of air rights, consideration must be given to the present, the period during the life of the lease, the end of the lease, and the means of completing the project. Therefore, complete information and background must be secured

on the developers. Just as important as the developers are the architect, the contractor, and the financing, both interim and permanent.

This is why it was stated previously that negotiating an air rights lease is far more satisfactory than requesting bids. Over a period of time, all the desired information can be secured and if it isn't then there is no lease.

The involvement of more than one ownership poses a serious problem that must be resolved. When the term of the lease expires, provisions must be made for legal ingress to and egress from the structure. If not an isolated structure remains and, therefore, must be demolished. The various agencies of the State do not have the authority to seize or purchase in order to provide ingress to or egress from the structure at the termination of a lease. The project or projects proposed by your study involving more than one ownership and referred to previously must take into consideration the disposition at the termination of the lease and the controls before, during construction, and after construction. The fee ownership by the Massachusetts Bay Transportation Authority between fee ownership of the Commonwealth of Massachusetts, Department of Public Works poses a serious problem.

It is my opinion that there is no value to the air rights of the Massachusetts Bay Transportation Authority as they exist by themselves because of footing and column locations, the width of the structure, and the ingress and egress to it. However, the MBTA is in a position to hold up a project unless it receives what it desires. The ultimate goal of negotiating air rights leases is the lease itself. However, just as important as the lease is the construction agreement, which may or may not be part of the lease and the option agreement. The construction agreement ceases to be effective after the lease is signed.

My experience indicates that proposals are submitted by developers based on architect's conception with utter disregard for the engineering aspects. As a result, these proposals fall by the wayside. Also, a period of approximately two years of negotiations is required before a lease is realized.

During the negotiation period, many conferences are held with the engineers and attorneys of both parties and the architect in order to advise everybody concerned as to what the requirements of the Authority will be and what conditions will be included in the various instruments referred to previously.

The lease rental figure is not discussed until near the end of the negotiations. In my experience in determining a lease rental value, it has been necessary to use abutting land values as a base and make adjustments to compensate for the additional costs resulting from the working and location conditions. The developer determines his lease rental value from the cost of and income from his project. This determines what he can afford to pay. From this point on, the rental figure is negotiated.

During these stages, the developer must know what the conditions of the construction agreement will be as they will influence costs. The construction agreement will indicate the restricted working hours, mainly the commuter period, the number of lanes that can be closed and for what periods, the season of the year that foundation work cannot be done, the the temporary lighting system, the necessary coning and police protection for safety purposes, the location of heavy equipment in the travelled way, and the time and method of stringing beams or girders over the travelled way.

Control of the project is retained, in the case of the Authority, by requiring approval of the architectural design and finish by the members of the board prior to the granting of a base, and the approval of all plans and specifications by the chief engineer of and the consulting engineer for the Authority.

During the negotiating period, complete cooperation is given to the developers by supplying all engineering, as-built and boring plans and by cooperating with and conferring with the various city departments. As these negotiations progress, the type of project becomes more evident with the result that more specific advice can be given. As an example, any windows over the travelled ways must be permanently locked and no portion of the roof over the travelled way can be available for use. This condition has an effect on apartment houses. The option agreement is becoming more and more important as a document because it is an instrument that the developer can use to approach prospective tenants and financing institutions. The option agreement, which is for a specific period of time with a right for an extension for a short period, will contain the rental figure and method of payment, the minimum size of the project and the full

disclosure requirements for principals, architect, contractors and financing, both interim and permanent.

It is estimated that the period of time for the completion of a high rise air rights development, after the granting of an option agreement, will be between four and five years. The desire of the developer will be to conduct the project in phases so that while phase two or later phases are being constructed income will be coming in from phase one or other phases completed. Therefore, taking into consideration the preliminary negotiating phases, the option agreement time and the period of construction, it could well be approximately six years before an air rights project is completed.

Of great significance is the fact that the Massachusetts Turnpike Authority, by two of its air rights projects, has proven that construction can take place on a high-speed operating toll highway without disrupting or impairing the freedom of the traffic and without presenting any serious safety hazards.

The proper type of project in the proper location can be a key factor in raising the economic conditions in an area with a resultant increase in land values resulting from new or rehabilitated commercial or residential complexes.

It is generally recognized that the Star Market, which built on air rights in Newtonville, was a factor that kept the Newtonville area, with its banks and small individual stores, as an economic entity with a future. It is also the opinion of many that the Gateway Center, an air rights project in Newton Corner, when completed, will be the basis of the rehabilitation and revitalization of the Newton Corner area.

John McCue, Real Estate Department
Massachusetts Turnpike Authority

APPENDIX C

AIR RIGHTS CONSTRUCTION

Nichols, Norton and Zaldastani, Inc. are co-principals with I.M. Pei and Partners in the design of an air rights development for the John Hancock Mutual Life Insurance Company in Boston. The development, an eight story parking facility with retail space and a restaurant on the first level, is located over the Massachusetts Turnpike between Clarendon and Dartmouth Streets. Working drawings for this development are complete and the project is presently under construction.

Some of the experience, information, and insight gained during the course of this project will be related in this report to facilitate a more informed evaluation of the influences affecting air rights construction and their effect on the highway under construction. Although approximate costs can be provided for only a small number of items which influence the overall costs incurred in this kind of construction, it is intended that a basis for determining the other costs will be indicated.

There are three major factors to be considered in an examination of the interaction between a highway and an air rights development. These are the factors influencing the design and operation of the completed development, and the factors influencing the construction process.

FACTORS INFLUENCING THE DESIGN AND OPERATION OF THE HIGHWAY. The satisfactory design of a highway requires that a number of physical demands be met. For example: to assure a free flow of traffic, it is clearly desirable that supports for any structure should not penetrate established roadways or the side clearances required for safety. Normally the location of supports can be made to coincide with existing overpass bridge piers. However, since the investment in an air rights building would normally preclude its removal for highway widening, consideration of the possible need for future widening of the highway must be carefully assessed. As an example, construction of an air rights structure over Route 128 when it was first completed would have restricted the recent widening of that highway, where short span overpasses were replaced with bridges of larger span.

During construction of a highway it is common for foundations of bridges to encroach on the side clearances of the roadway. The installation of such foundations for air rights structures, following completion of the highway, would impede traffic. When an air rights construction is anticipated on the highway, it may be desirable to provide additional clearances adjacent to the roadway to permit installation of the appropriate type of foundation, thereby ensuring unimpaired operation of the highway. The expense of such a provision should be balanced against the expense of providing traffic control and policing each time an air rights development is constructed, the additional cost of construction under such operating conditions, and the restrictions imposed upon the selection of the foundation.

At the location of the John Hancock project the roadway is depressed below the natural ground water level of the surrounding area. The highway was constructed as a boat section incorporating a three foot thick concrete mat to counteract the hydrostatic uplift imposed by the ground water. It was necessary to maintain the level of the existing water table because of the many buildings adjacent to the turnpike supported on wood pile foundations. Installation of the foundation for the project required penetration of this mat and prevention of the release of water onto the roadway. It is considered that recognition of the expense and difficulties encountered by the penetration of such concrete mats, and by the subsequent protection of the highway against ground water seepage, can lead to an appropriate design when air rights developments are anticipated at locations where the roadway is depressed below the natural ground water level.

Model of the John Hancock Garage now under construction over the Massachusetts Turnpike near Copley Square.

The use of the internal combustion engine by present automobiles requires provision for dispersion of the gases produced. On the open highway the gases are rapidly dissipated in the surrounding atmosphere. However, the development of an air rights structure restricts the circulation of air above the highway, particularly when the highway is depressed or partially enclosed on either side. A study of the air flow beneath the structure may indicate the necessity for some form of mechanical ventilation. Our experience indicates that such ventilation should not be considered on a project by project basis, but that an overall plan for each segment of highway subjected to air rights development be established so that ventilation adequate for the safe operation of the highway is provided at all stages of construction. Such a plan may well establish restrictions to the enclosure of the highway which must be considered in the program of an air rights development.

It must also be recognized that in order to ensure safety of the highway operation during daylight hours, lighting of relatively high intensity must be provided where the highway is covered and that particular care should be exercised in designing the point of transition from daylight to artificial lighting.

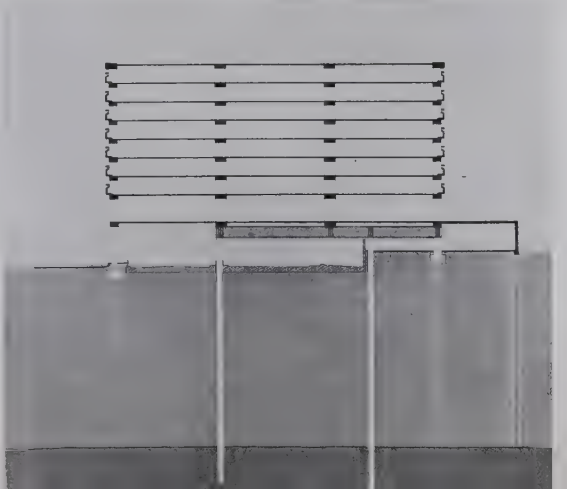
The lighting required will be similar to that used in vehicular tunnels. It is estimated that the present cost of installing such lighting is approximately $2.00 per square foot of roadway surface. Operating and maintenance expenses are in addition to the initial cost of the installation.

After completion of the air rights structure, periodic interruption of traffic flow may be required for such operations as painting and servicing overhead utilities. It would appear desirable to reduce or eliminate this necessity by proper control of these factors in the development of the design. The fact that the highway is protected from the adverse effects of weather is an advantage.

FACTORS INFLUENCING THE DESIGN AND OPERATION OF THE DEVELOPMENT. In addition to the usual performance requirements established for a building, the design of air rights structures must take into account the additional factors peculiar to such a development.

In general, it will be determined that the appropriate vertical support (or column) system for the proposed air rights building

Cross sections through the Hancock Garage showing pile foundations and transfer beams.



will not be coincident with the permissible location of supports adjacent to the roadways. As a result, it will be necessary to introduce an intermediate structure which will be capable of satisfactorily transferring the building loads to the available foundation. This intermediate structure must possess particular characteristics in order to ensure proper performance of the superstructure both during construction and after completion of the building. The most significant of these characteristics is its performance with regard to deflection. Consideration must be given to the fact that the building is, in principle, supported on an elastically deflecting foundation. The economics of the intermediate structure make particularly relevant the amount of dead load and the amount of live load applied by the superstructure. It can be concluded that the buildings which are most appropriate for air rights development are those of light construction and, more particularly, those having a low live load requirement, such as housing. The depth of the intermediate structure may be considerable. This must be considered in establishing the relative elevations of the first level of the structure and the roadway, unless a particular solution suited to a specific set of conditions, such as the Newton Corner development over the Massachusetts Turnpike, permits location of this intermediate structure above the first level.

Apart from the intermediate structure required to transfer loads from the upper levels of the superstructure to the foundation, it is necessary to create a platform above the roadway. Since the first level of a building is normally supported by the ground, the provision of this special first level structure is a penalty associated with air rights development. The penalty for this structure, considered apart from the provision of the intermediate structure, is expected to be between $10.00 and $15.00 per square foot. In addition to its structural function, this platform must be capable of insulating the building from the fumes, vibration, noise and thermal conditions of the roadway. It is also important to recognize that service utilities which are normally distributed beneath the ground must be distributed to an air rights structure in some other manner. When it is necessary, for such reasons as drainage, to distribute services below the first level, consideration must be given to the protection of these services from exterior conditions and to provision of access for maintenance purposes.

For a building constructed prior to completion of the highway, as in the case of the Star Market in Newton and the Prudential Center in Boston, normal construction procedures may be followed. However, when it is necessary to construct the building while the highway is in operation, it is imperative that construction procedures be considered in the design to ensure safe and economical construction with the least possible interference with normal highway operation.

An extremely important consideration is the means of access to the building. In many instances major highways in the city are not directly related to the network of city streets, so access to air rights structures may require new roadway construction adjacent to the highway or accessways from existing bridges crossing the highway.

FACTORS INFLUENCING CONSTRUCTION. Apart from the many considerations already stated in this report, several factors must be considered when construction must take place while a highway is in operation.

Any construction requires a staging area, adequate access for equipment, and storage space for equipment and materials. Such space in conventional construction is available on the site. In air rights construction such space is not available. A median strip, if of sufficient width may provide some working space, but the servicing of this space is difficult and not consistent with safe traffic operation. Space directly adjacent to the highway is more suitable but this must still be serviced from the highway -- which is likely to have restricted access and one-way traffic flow. The site would be best serviced from space adjacent to the highway which can be reached through the local street system. Thus the availability of land adjacent to the site is of great importance in the selection of a location for air rights development. At the John Hancock project such land is available only on one side, since the Penn-Central Railroad tracks are located to the south. Access is available, however, at either end of the site from bridges spanning the highway, and a scheme has been devised which enables materials to be transferred from these points to their final position in the structure as shown. When access to a site is limited, a procedure similar to that illustrated may be adopted since a temporary bridge crossing the highway may always be constructed if such a structure is not already present.

Although the foundations and vertical supports may be installed outside the limits of the roadways, it is necessary that horizontal members be installed over traveled ways. In order to reduce interference with normal traffic to a minimum, it is clearly desirable to speed construction by the use of prefabricated floor elements and to restrict traffic flow

only during the construction of the floor immediately above the highway. This may be accomplished by means of pre-cast concrete or steel construction, although the latter would normally require subsequent fire protection. The erection of these elements at night would cause least interference with traffic.

SUMMARY. This report has attempted to outline the areas to which consideration must be given in developing sites for air rights construction.

In summary, additional costs are incurred by air rights construction in the following areas:

a) The provision and operation of mechanical ventilation, if required.

b) The provision and operation of lighting for the roadway.

c) The provision of an additional level of structure to support the first level, along with provision to protect this floor from the conditions of the highway.

d) The provision of an intermediate structure to transfer superstructure loads to the ground.

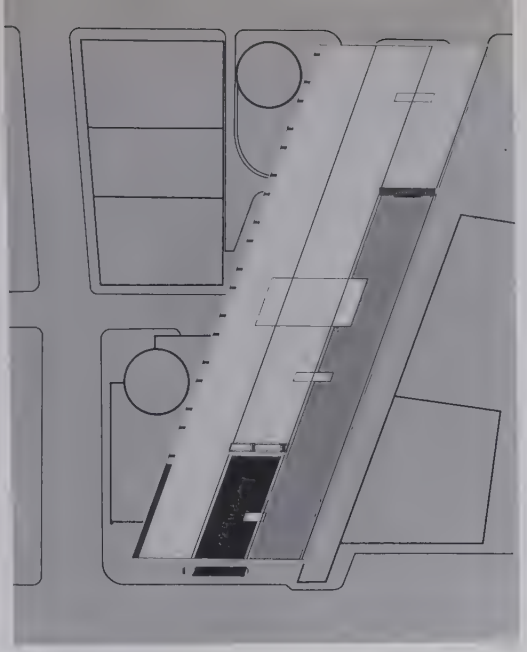
e) Special conditions for providing and servicing utilities at the first floor.

f) The cost of traffic control during construction.

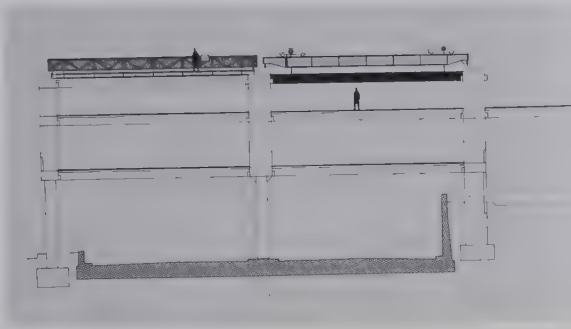
Additional costs may be incurred for such reasons as the reduction in efficiency of construction in constricted conditions and the necessity of working on the highway during off-peak traffic hours.

Although an indication of the actual costs likely to be incurred is subject to a large number of variables, it is considered that the following table will indicate a range of costs that can be assigned to the areas listed above.

a) $0 - $2.00 per sq. ft. roadway.



Diagrammatic plan and section of the Hancock Garage showing steel girders and prefabricated floor elements being transferred from the cross street access point to their final position in the structure.



b) $0 - $2.00 per sq. ft. roadway.

c) $10.00 - $15.00 per sq. ft. of first level structure.

d) $0 - $5.00 per sq. ft. of constructed floor.

e) $0 - $0.50 per sq. ft. of first level structure.

f) $0 - $1.00 per sq. ft. roadway.

In the past, large scale reclaimation work has been undertaken to create additional land areas adjacent to densely populated areas. The filling of the Back Bay in the latter part of the nineteenth century was one such project. Recently, it has been recognized that our modern transportation networks, particularly highways, make poor utilization of land in our densely populated cities. In Manhattan, for example, highways and streets occupy over fifty percent of the land.

The use of air rights effectively creates additional land area. Where densities and land values are high, this may prove to be economically sound. In areas where land values are lower and the additional costs of construction incurred by the use of air rights cannot be directly justified economically, benefits may accrue in building or maintaining links between segments of the city which can be justified on environmental or sociological grounds.

At each location where the use of air rights is considered, an analysis will be required to determine the additional cost of construction that will be incurred. It is considered that such studies will frequently lead to the conclusion that the use of air rights will prove not only desirable but sound planning.

Michael J.A.H. Jolliffe
Nichols, Norton and Zaldastani

APPENDIX D

DEMOGRAPHIC DATA

POPULATION. The following discussion and tables present the best available socio-economic and demographic data for the Southwest Corridor area. As described in the text, the population of the Southwest Corridor has drastically declined over the past twenty years. In addition, it has become much more of a black area and has undergone changes due to large-scale in and out migrations of different ethnic groups.

SOUTHWEST CORRIDOR STUDY AREA
POPULATION 1950-1968

	1950[1]	1960[1]	1968[2]	% Change 1950-1968
Roxbury	87,711	67,615	34,680	-60%
Jamaica Plain	38,303	36,476	25,800	-37%
Roslindale	12,237	13,721	8,110	-34%
Total Study Area	138,251	117,812	68,590	-51%

PROPERTY OWNERSHIP AND PHYSICAL CONDITION. In 1968, 75% of the city of Boston's residents lived in rental housing units. The rental unit breakdown within the corridor study area was 91% for Roxbury, 71% for Jamaica Plain, and 66% for Roslindale. Property ownership is lowest near the urban core in areas such as Roxbury, but by contrast there is no census tract within Roslindale with less than 23% owner-occupied units.

Although there is good housing in all three communities within the study area, the physical condition of housing generally improves as one moves away from the central city. The following table indicates that at the time of the 1960 census 60% of the Roxbury houses were considered in good condition as compared to 77% for Jamaica Plain and 90% for Roslindale. At that time major concentrations of sound housing structures were in the

1. 1950, 1960 US Census of the Population.
2. Polk Survey Company, 1968 Estimates of the Population.

Jamaica Center area -- between Centre Street and the Jamaicaway and between Centre Street and Chestnut Street, along Washington Street in the Forest Hills-Roslindale section.

CONDITION OF HOUSING[3]

	SOUND	DETERIORATING	DILAPIDATED
ROXBURY	60%	29%	11%
JAMAICA PLAIN	77%	17%	6%
ROSLINDALE	90%	9%	1%
TOTAL	67%	24%	9%

Since 1960, however, some rehabilitation of brick town houses in the Fort Hill area, several new housing developments in Roxbury, and the presence of the Model City Administration have served as rehabilitative forces.

The housing adjacent to the Southwest Corridor ROW is characterized by predominantly deficient housing. There have been few signs of improvement since the announcement of the corridor. Property owners appear to be waiting until after the highway is built before spending money on major repairs.

3. 1960 US Census of the Population.

ETHNIC CHANGES. In 1960, 40% of the population in the Roxbury section of the study area was black. In contrast, only 1% of the population in the Jamaica Plain section and 3% in the Roslindale section was defined by the 1960 census as non-white. The two accompanying drawings show dramatically the shifts of ethnic groups between 1960 and 1965. In 1960 only seven of the sixteen census tracts in the Roxbury section were predominantly black, while five years later twelve of the sixteen had become predominantly black. Prior to 1960, the black population had tended to move from Roxbury south to communities like North Dorchester and Mattapan, bypassing Jamaica Plain and Roslindale. But the most recent trends are for blacks to settle in the northeastern sections of Jamaica Plain.

In addition to black in-migration in Jamaica Plain, there has been recent in-migration of Puerto Ricans and Cubans. Jamaica Plain has always had a large proportion of people of foreign stock. In 1960 half of the Jamaica Plain population was listed in census data as of foreign stock.

PERCENTAGES OF BLACKS IN ROXBURY
1960-1967

CENSUS TRACT	% BLACK 1960 [4]	% BLACK 1967 [5]	% CHANGE
Q-2	21%	79%	+58%
R-1	95%	99%	+ 4%
R-2	54%	97%	+43%
R-3	83%	93%	+10%
S-1	31%	53%	+22%
S-2	2%	43%	+41%
S-3	30%	68%	+38%
S-4	6%	11%	+ 5%
S-5	4%	8%	+ 4%
S-6	2%	6%	+ 4%
U-2	78%	96%	+18%
U-3	51%	96%	+45%
U-4	58%	86%	+28%
U-5	88%	96%	+ 8%
V-1	17%	58%	+41%
V-2	13%	53%	+40%
TOTAL	40%	66%	+26%

4. 1960 US Census of the Population.
5. Boston's Center City Community, Volume 2, 1969, pp. A-20-A26.

HEAD OF HOUSEHOLD. In the Roxbury section of the study area 40% of the households area were headed by women, compared to 30% in Jamaica Plain and 20% in the Roslindale section. For those households with children under eighteen, 26% of those in the Roxbury section are headed by women compared to 9% in Jamaica Plain and 8% in the Roslindale area. In the city of Boston as a whole, 31% of all households are headed by women, and 16% of those households with children are headed by women.

Increased proportions of households headed by women, especially households with children, indicate certain community problems and needs. Generally, these women receive some public assistance, but often require a variety of community services such as day care centers and specially oriented job training and educational programs which are not available to them.

HOUSEHOLD SIZE. On the basis of 1968 survey data and within the twenty-five census tracts defined in this report at the study area, the average household size increases the further one moves from the central business district. In the Roxbury section, 57% of the households are composed of more than one person compared to 73% for the rest of the study area.

Roughly 24% of all households in the Roxbury section of the study area have children, compared to 30% in Jamaica Plain and 38% in Roslindale. Census tracts in the Roxbury section vary from 1/7 to 4/9 children per household, compared to a lower range of from 2.3 to 2.7 children per household in the rest of the study area. This indicates that the typical dwelling unit in Jamaica Plain and Roslindale is more likely to be a household with children than in Roxbury and that the number of children is generally between two and three. In Roxbury, the composition and size of households like most other socio-economic variables varies to a much greater extent than in Jamaica Plain or Roslindale.

EMPLOYMENT. On the basis of the 1960 census, approximately 45,000 residents of the study area were employed. Current employment estimates are unavailable for the study area, with the most recent based on 1963 data. Because of the large decline in population, this data would be misleading. Although total figures are not available, occupational breakdowns based on the 1968 Polk Survey indicate that 42% of the total adult population in Roxbury was employed in non-professional, non-managerial occupations, compared to 46% in Jamaica Plain and Roslindale. Throughout the study area, half of the employed males work as skilled, semi-skilled or operative workers, the largest single group being the operative workers.

Since there is not income data more recent than 1960 it is only possible to highlight the obvious patterns. The Southwest Corridor study area has a lower median income level than the city of Boston average. Some of Boston's poorest sections are located in the northeast section of the corridor in Roxbury. It is also unfortunate data on place of employment was not available for this report.

POPULATION SHIFTS. As the population of the Southwest Corridor area decreases and becomes proportionally more black, it is also undergoing other changes. Increasing proportions of households are being headed by women and the proportion of owners is decreasing.

The areas illustrating the greatest amount of population turnover are those with the greatest amount of black in-migration. These areas, too, illustrate the general under-representation of homeowners among the black population. The median proportion of new households in each of the twenty-five census tracts in 1968 was under 35%, but in four of the tracts with the greatest increases in black population there was a minimum of 50% turnover in 1968. In all but a few census tracts, at least 90% of the new residents were renting.

Although the median age of the corridor population was older than that for the city as a whole -- 34 in 1960 -- the proportion of new residents, particularly in Jamaica Plain, with children, is higher than for the existing population and indicates a trend toward a decreasing median age. All of the census tracts in Jamaica Plain show proportional increases of new residents with children and four tracts, all of them directly adjacent to the corridor, show increases of ten percent or more. These data may be an indication that the downward trend in population may be beginning to reverse itself in the study area.

APPENDIX E

BELOW WATER TABLE CONSTUCTION

This memorandum concerns construction problems and possible alternatives for the construction of the depressed section of the Southwest Expressway, Interstate 95, from approximately Station 350+00 to Station 478+50 = 25+00 (at Walk Hill Street) and on to Station 50+00 (north of relocated Roxbury Street).

PROPOSED SECTIONS. Two general roadway grades are proposed. The depressed twenty-foot section is a boat section below the water table. The maximum depth below the present water table is about eighteen feet at station 405, but in general it is less than fourteen feet. The depressed ten-foot section is above the water table, except between stations 380 and 410, where it is below the ground water table. It is much less expensive than the depressed twenty-foot section, but needs a wider right-of-way at some cross streets and higher bridges.

The deeper section is a conventional boat section, a design for which a huge body of experience has been accumulated. We have examined the soil conditions and construction problems along the corridor, primarily to devise design and construction procedures for the deep section that are more economical than the full boat presently proposed.

SOIL CONDITIONS. The topography in the Southwest Corridor is variable with several hills on both sides of the alignment of the proposed highway; the highway follows a depression or valley between these hills. Depth to bedrock is variable, from zero probably to over 100 feet, and the quality of the rock is likely to be poor.

The soils above bedrock are primarily granular, ranging from gravels to fine sands and silts. Just north of the Arborway interchange, a few borings show gray or brown silty clay, possibly more than thirty feet thick in places. Over most of the area this clay is absent or grades into silt strata, and where it is found, it is generally stiff.

The ground water level has been measured in many wells along the alignment; it varies both in the longitudinal and the lateral direction. The ground water table is generally between elevations seventeen and twenty-five, and there are indications of seasonal variations of several feet.

DESIGN POSSIBILITIES AND CONSTRUCTION IMPLICATIONS. The big difficulties in the deeper section result from its location below the water table. The design must account for the uplift pressures exerted by the water against the bottom of the structure. These pressures can be counterweighted, relieved, or both, but they cannot be ignored. The design can:
1) counterweight (as with the concrete material used as ballast in the present design) or anchor the structure against uplift;
2) relieve the pressures by lowering the ground water table; or
3) combine these approaches in several ways. Given the permeable granular soils of the Southwest Corridor, each of these possibilities has its own advantages and disadvantages.

The use of ballast requires a deep excavation below the ground water table and will cause at least a temporary lowering of the ground water, unless excavation is performed in the wet (with tremie concrete for the gravity bottom slab) or with a controlled ground water recharge adjacent to the excavation. Construction in the wet is fairly expensive and ground water recharge is sometimes of dubious value. Complete cut-off of ground water flow towards the excavation by sheet piles or, slurry-trench walls, is not practical because of the substantial depth of the permeable deposits, but some reduction of water flow may be achieved, depending on the depth of the walls.

However, a temporary lowering of the ground water table is not objectionable, and a permanent ground water lowering of limited height may be acceptable. None of the soils in the area appear to be particularly susceptible to settlements; most settlements would occur rapidly, and would be incurred during a temporary construction drawdown anyway. Part of the permanent elastic settlements of the neighborhood, caused by ground water lowering, would be counteracted by heave from the reduced load of the roadway.

It has been suggested that tension piles would not be economical because less than 800 pounds per square foot of pile tension capacity could be achieved, and conventional bearing piles used in tension have sometimes failed to develop their design capacity with disastrous results. However, a reinforced bulb-ended pile (the Franki, for example) or prestressed grouted anchors could almost certainly be counted on for permanent uplift capacity in these granular soils. Pending analyses and load tests, therefore, we feel that a partially floating anchored section would be technically acceptable and economical in comparison to the full boat section presently proposed.

The partially floating boat section would be a compromise solution embodying favorable portions of a variety of methods. It would involve a partial lowering of the ground water table of five to ten feet, depending on the elevation of available outfall into sewers. The reduced uplift pressure would be counteracted by a combination of the weight of

the watertight concrete boat section -- which should be as light as practicable -- and anchor piles as necessary to fulfill the requirements for uplift. In most instances, only a small number of tension piles -- or none at all -- would be required. In some instances it is possible to obtain economical resistance to uplift by cantilevering the bottom slab laterally beyond the walls; the soil fill above these wings would act as inexpensive gravity load.

SUMMARY. It is felt that since a temporary ground water lowering will, in any case, almost necessarily be the result of construction, and settlements are rapid, a small permanent lowering of the water table could be performed without appreciable additional settlements. Since the tension piles would only take a small portion of the uplift pressures, their use might not be objectionable to the authorities.

The combination of ground water lowering, dead weight, and tension piles would make it possible to devise a much more economical solution than any one of the approaches alone. No permanent pumping would be required, and construction problems would be eased by somewhat shallower excavations. Nonetheless, there is little doubt that the deeper alternative of the depressed twenty-foot sections will be more expensive than the shallower one.

It has not been possible for us in the limited time and with limited information to work out accurate cost estimates, so we are not able to be more specific about the possible economies.

Finally, we recognize that the alternate solutions proposed here for the deep section are unconventional construction, and require special caution in design and construction on that account. Various public agencies, for example, have proscribed tension piles except as a temporary construction expedient. It should be pointed out, however, that construction projects as large and complicated as this are nearly always unique, and even the conventional boat section may well encounter construction difficulties that were not fully foreseen. On this project, seasoned engineering judgement of soil conditions and construction methods is probably more valuable than direct comparative experience with the same design constructed in different ground. Consequently, we think the alternate design can be seriously considered.

Birger Schmidt
James P. Collins and Associates

APPENDIX F

ADDITIONAL LAND ACQUISITION: DEPRESSED 10 FOOT

Area 2 EAST SIDE

Northeast corner of Elmwood Place and Elmwood Street:
- Residential structure;
- Commercial structure;
- Vacant lot.*

Northeast corner of King and Elmwood Streets:
- Vacant lot.*

Area 4 WEST SIDE

North side of Heath Street at Lamartine Street:
- Commercial structure.

EAST SIDE

Northeast corner of Highland and Centre Streets:
- Commercial on first floor with residential above;
- Vacant lot.

Southeast corner of Centre and Highland Streets:
- Residential structure.

Area 5 WEST SIDE

Northwest corner of Mozart and Lamartine Streets:
- Five residential structures;
- Vacant lot;
- Commercial on first floor with residential above.

Southwest corner of Mozart and Lamartine Streets:
- Two residential structures;
- Vacant building;
- Commercial structure;
- Vacant lot used as access to above.

Lamartine Street between Boylston and Paul Gore Streets:
- Two commercial structures;
- Three vacant lots;
- Residential structure;
- Commerical structure with residential above.

EAST SIDE

North side of Atherton Street at Corridor:
- Residential structure;
- Two vacant lots.

South side of Atherton Street at Corridor:
- Industrial structure.*

North side of Boylston Street at Corridor:
- Commerical structure;
- Parking lot.

South side of Boylston Street at Corridor:
- Residential structure.

Area 6 WEST SIDE

Northwest corner of Green and Oakdale Streets:
- Playground.*

Southwest corner of Green and Oakdale Streets:
- Commercial with residential above.

EAST SIDE

North side of Green Street between Amory Street and Brookside Avenue:
- Two industrial structures;
- Two commercial structures;
- Two vacant lots;
- Residential structure;
- Commercial with residential above.

Northeast corner of Green Street and Brookside Avenue:
- Industrial structure;
- Commerical structure.

South side of Green Street at Corridor:
- Three commercial structures with residential above;
- Vacant lot;
- Commercial structure.

*Property damaged but not taken.

Type of Structure	Industrial	Commercial	Residential	Commercial-Residential	Vacant Structure	Vacant Lot	Parking Lot	Playground
Area 2	-	1	1	-	-	2*	-	-
Area 4	1	1	1	1	1	1	-	-
Area 5	2 (1*)	3	12	2	1	7	1	-
Area 6	3	4	1	5	-	3	1	1*
TOTAL	6	9	15	8	2	13	2	1*

*Properties damaged but not taken.

APPENDIX G

SOCIAL IMPACT

This study was designed to determine the extent to which embanked and depressed expressways differ in their effects on nearby residents. Because much planning literature advocates depressed highways for urban areas without providing substantiating evidence, it was felt that issue needed further exploration.

On the basis of the study pre-test in November 1969, along the Massachusetts Turnpike in Newton, it became clear that respondents feel few expressway effects if they live more than two blocks away. In order to avoid confusing effects primarily due to distance from the expressway with effects primarily due to the vertical profile, the analysis kept these two series of variables distinct.

Chicago was chosen as the site for this study because it is one of the few places where facilities similar in design to the Southwest Corridor have been constructed. Like the Southwest Corridor, the Chicago study area surrounded a 250-foot wide highway/rapid transit facility, in predominantly residential areas. The study areas were similar to the Southwest Corridor area in socio-economic characteristics and distance from the central business district. The study areas were along the Kennedy and Congress Street Expressways, which have been in operation for several years.

The Kennedy Expressway has four traffic lanes in either direction and rapid transit facilities under construction in the median. It is both depressed and embanked within a one-half mile section, offering a prime area for studying design-related effects. The Congress Street Expressway, although depressed, has the same number of traffic lanes and operating rapid transit. Therefore, the sample included areas near both facilities to cover the three major variables: design, mass transit in the median, and distance from the expressway.

The Kennedy sample included six groups: three for each vertical profile. On both sides of the expressway, people were interviewed who lived adjacent (whose property lines abutted the right-of-way), who lived between one and two blocks away from the right-of-way, and who lived between three and four blocks away. On the Congress, the sampling was the same except that there was no sampling for an embanked section as the Congress is completely depressed.

The kinds of questions that would best assess the differences among the sub-samples in terms of distance and alignment were developed to emphasize the extent to which people were aware of the expressway before the expressway was mentioned by the interviewer. Questions concerning people's movements across the expressway, questions to determine the effects of the expressway on people's behavior, and questions to determine their attitudes toward their neighborhoods and toward the expressway formed the major part of the interview.

Since the total sample was slightly under 200, these responses themselves are not necessarily reflections of general attitudes and behavior, although they certainly are suggestive. What the study was intended to accomplish, and did accomplish, was to analyze the differences in response between those living near an embanked road and those living near a depressed road, and those living at various distances from the two types of expressways.

Since the primary impact of the design of the expressways is on individuals living near the expressways, community impact could only be analyzed in terms of individual behavior and attitudes. Ideally, this study would have included a community component which would have investigated the aggregate variables such as traffic -- both automobile and pedestrian, new commercial and residential development, changed social networks and patterns of movement. The information gathered from what was surveyed, however, casts some doubt on the existing planning assumptions and provides information about expressway and rapid transit use which will be helpful in the planning of transportation facilities.

CHARACTERISTICS OF THE SAMPLE. Approximately three-fourths of the total sample live in their own homes, and the entire sample is white. Over half of the respondents have lived in the same neighborhood for more than ten years and about one-third have lived in the same house for at least ten years. The majority -- eighty-one percent -- of the respondents are married. Three-fourths of them have children, and slightly over half -- fifty-five percent -- have children under eighteen.

The three areas differ in terms of neighborhood stability with those living in the embanked section of the Kennedy being the most stable: fifty-seven percent of the respondents have lived in the area for ten or more years compared to forty-six percent for both the depressed sections. Only thirty percent of those living in the Congress area have lived in the same house for ten or more years compared to forty-three percent

who have lived in the same neighborhood for as long. This indicates that people tend to move more within the neighborhood as well as from other neighborhoods in the Congress sample than in the two Kennedy samples. The area around the Congress is much more racially diverse than the area around the Kennedy and this may account for the greater mobility of its residents.

The proportion of people who have had some college education increases as one moves away from the expressways. Only fourteen percent of all those living adjacent have had any college education, compared to twenty-six percent of those living between one and two blocks away and forty-seven percent of those living three to four blocks away. The level of education also varies by area. Over one-third of those living in the Congress area have been to college, compared to only fourteen percent of those in the depressed section of the Kennedy and twenty-four percent of those living in the embanked section of the Kennedy.

The highest proportion of professional and technical employees --thirty-six percent -- is found in the Congress area, increasing as one moves further away from the expressway. For the sample as a whole, thirty-eight percent are employed as blue-collar workers, twenty-one percent as white-collar workers, nineteen percent as professional and technical workers, and fourteen percent are retired. The proportion of blue-collar workers in the Congress area decreases from thirty-five percent to ten percent as the distance increases from adjacency to three to four blocks away. This pattern is not as clearly repeated in the Kennedy area. There, only slight differences distinguish the two vertical profiles by distance, and both Kennedy samples are considerably less professional-technical and white collar than the Congress sample.

These data indicate that the areas furthest away from the expressways tend to attract and keep more middle class families. However, differences in the upkeep of homes, activities, and attitudes toward neighborhood cannot be attributed simply to social class since the kinds of things which are similar among the sub-samples tend not to vary significantly within the relatively narrow range of social class found in the three samples.

Although a large amount of data was gathered on general neighborhood attitudes as a means for getting respondents to mention expressway related factors spontaneously and thus not bias the information gathered, the data presented below will pertain specifically to the impact of the expressways. Rather than develop any general conclusions about the kinds of things people are concerned with, the following summary emphasizes the behavior and attitudes which are directly related to the expressways.

FINDINGS

LANDMARKS. The extent to which respondents mentioned the expressway as a neighborhood landmark indicates how much of a definitive feature they feel it to be. The question of neighborhood landmarks was asked before respondents had any idea that the study concerned more than general neighborhood attitudes. Although almost all of the respondents mentioned community facilities such as parks, playgrounds, schools and churches as landmarks, over half also cited the expressway. One-third mentioned commercial facilities, and less than ten percent cited neighborhood social characteristics, their own homes, or local streets.

Whether the expressway was cited as a landmark varies considerably with both distance from the expressway and vertical profile. Sixty-seven percent of those living adjacent to the expressway cited it as a landmark compared to forty-nine percent of those living between one and two blocks away and nineteen percent of those living between three and four blocks away.

Comparing the depressed and embanked profiles of the Kennedy, seventy-five percent of those living where the road is depressed cited the expressway as a landmark while only forty-nine percent of those living where it is embanked did. The difference between the two sections of the Kennedy counters the assumption that people living near an embankment are more aware of it than people living near a depressed roadway, when the roadway is approximately 250 feet wide.

THE EXPRESSWAY AS A BOUNDARY. People's greater awareness of the depressed facility is reinforced by responses to the question: "Do you consider the expressway as part of your neighborhood, or do you consider it a boundary?" Fifty-one percent of the total sample said they considered it part of their neighborhoods while forty-three percent said they considered it a boundary. Four percent said it was fur-

ther than a boundary and two percent didn't respond. Those who considered it further than a boundary all lived in the area furthest from the expressway -- between three and four blocks away.

EXPRESSWAY AS NEIGHBORHOOD BOUNDARY

Distance

	Adjacent	1-2 Blocks	3-4 Blocks
Part of Neighborhood	56%	52%	39%
Neighborhood Boundary	44%	48%	61%

Profile

	Embanked	Depressed
Part of Neighborhood	69%	49%
Neighborhood Boundary	31%	51%

Comparing the depressed and embanked samples, fifty-one percent of those living in the depressed section thought of the highway as a neighborhood boundary, whereas only thirty-one percent of those living in the embanked section felt the expressway was a boundary. Naturally, those living furthest from the expressway would tend to consider it more of a boundary than those living closest to it, and forty-three percent of those living adjacent, forty-five percent of those living one to two blocks away and fifty-eight percent of those living three to four blocks away considered the expressway a boundary, or further than a boundary.

The biggest difference -- fifty-one percent of the depressed sample compared to thirty-one percent of the embanked -- is a function of highway design, rather than distance from the highway. This indicates that whether or not a transportation corridor is considered a barrier strongly depends on its design. The data below on crossing the expressway give behavioral support to this difference in attitude.

CROSSING THE EXPRESSWAY. Although a large proportion --eighty-three percent of the total sample--cross the expressway for shopping and other activities, sixty-nine percent of those who cross, cross only by car. It has been posited that an embanked facility inhibits walking to the other side, but the data tell a different story. Only fourteen percent of those who live along and cross the depressed section of the Kennedy ever walk across it compared with twenty-nine percent of the embanked sample. Since both the embanked and depressed samples were equally drawn from each side of the expressway, since the two sections are side by side within a total area of less than a mile, and since the entire area in uniformly residential, the likelihood of this difference being due to other factors is quite small. This indicates that although much planning literature claims the contrary, having to cross under a viaduct does not inhibit crossing in general, and especially does not inhibit pedestrian crossing.

More pedestrians cross the Congress than cross either section along the Kennedy. This is probably because of the functioning mass transit in the median of the Congress. Only five percent of those who live along the Congress never cross, compared to twenty-five percent along the embanked. Of those who cross the Congress, forty percent walk across at least occasionally. This reinforces the notion that a median mass transit facility does generate cross-movement and in this way serves to reintegrate the community to some extent.

ATTRACTIVENESS. When asked whether they would rate their neighborhood "more attractive than average, about average, less attractive than average, or one of the least attractive in the city," only a minor difference can be determined between those living near both profile samples of the Kennedy. The important characteristic for determining attractiveness seems rather to be the distance from the expressway. Only eighteen percent of those living adjacent feel their neighborhoods were more attractive than average, compared to thirty-two percent of those living one to two blocks away and thirty-six percent of those living three to four blocks away. The effect of the expressway seems to diminish rapidly as soon as one is one block away since there is no significant difference between those one to two blocks away and those three to four blocks away. This is

reinforced by the absence of any "less attractive" or "least attractive" responses from those living furthest away compared to two percent for those living one to two blocks away and six percent for those living adjacent to the expressway.

NEIGHBORHOOD ATTRACTIVENESS RATING*

Rating	Distance		
	Adjacent	1-2 Blocks	3-4 Blocks
More Attractive than Average	18%	32%	36%
Average	66%	65%	64%
Less Attractive than Average	6%	2%	-

	Profile	
	Embanked	Depressed
More Attractive than Average	25%	25%
Average	64%	64%
Less Attractive than Average	2%	6%

The features most often cited as adding to the attractiveness of the neighborhood were individual property maintenance, and physical features such as wide streets and trees while fourteen percent mentioned the expressway and its convenience. Although no design-related differences emerged, distance had a significant effect. Twenty-six percent of those living three to four blocks away mentioned the expressway as an attractive neighborhood feature, compared to only eleven percent of those living adjacent to them, and twelve percent of those living one to two blocks away.

*Totals do not include "No Answer" and "Don't Know" responses so may not add up to 100%.

These findings are supported by the proportion of people citing the expressway as a reason people would want to move into their neighborhoods. Although seventy-nine percent of the total sample said they felt people would want to move into their neighborhood, only twenty-three percent mentioned the convenience of the expressway or the rapid transit along it. However, nineteen percent of those living near the depressed sections mentioned the expressway, compared to thirty-one percent of those living in the embanked section, indicating that residents in an embanked section feel the expressway is more of an advantage.

In terms of distance, twenty-eight percent of those adjacent, fourteen percent of those one to two blocks away and thirty-one percent of those three to four blocks away felt the expressway convenience was a reason people would want to move into their neighborhoods. Comparing this difference suggests that people living closest have more advantages -- as well as disadvantages, that people living furthest share mainly in the advantages, and that people living between are close enough to be somewhat bothered by negative highway effects but far enough away to ignore the road. Their denial of the road is a way of coping with its annoyances which do not affect those further away. Those living adjacent, on the other hand, are too close to ignore the expressway and must justify their remaining adjacent to it by emphasizing its positive aspects since they cannot ignore its negative aspects.

EXPRESSWAYS AS DETRACTING NEIGHBORHOOD FEATURES. Of all the things mentioned as detracting from the neighborhoods, one-fourth were related to the expressway in general and twelve percent concerned expressway dirt and noise. As would be expected, the majority of expressway-related complaints came from people living adjacent to the expressway. Forty-five percent of those adjacent said some aspect of the expressway detracted from the neighborhood and half of these complaints concerned dirt and noise. In comparison, only ten percent, essentially the same proportion of the complaints of those living one to two blocks away and of those living three to four blocks away concerned aspects of the expressway.

Comparing the depressed and embanked samples, it becomes evident that the embanked profile generates more complaints than the depressed. Only twenty percent of the complaints of the depressed sample referred to the expressway whereas thirty-two percent of the complaints of the embanked sample referred to it.

EXPRESSWAY COMPLAINTS

Detracting Feature	Distance		
	Adjacent	1-2 Blocks	3-4 Blocks
Traffic	22%	7%	2%
Noise and Air Pollution	23%	2%	6%

	Profile	
	Embanked	Depressed
Traffic	15%	17%
Noise and Air Pollution	18%	5%

Complaints about noise and air pollution account for the difference between the two samples. Eighteen percent of the embanked complaints were concerned with pollution, compared to only nine percent of the complaints of the depressed sample. This indicates that pollution is a much more significant problem for those living near an embanked highway and that this pollution is felt as far away as four blocks, whereas those living four blocks away from the depressed road did not complain about noise and air pollution.

Of the twenty-one percent who said people would not want to move into their neighborhoods, twenty-six percent cited the expressway as the reason and all of these people live adjacent to it. Here, vertical profile on the Kennedy made no difference since half live in the embanked and half in the depressed areas. Of these remaining who said people would not want to move into their neighborhoods, one-third stated or implied racial changes as the reason, eleven percent said the area was too close to the city, eleven percent said the people in the neighborhood were not friendly and nineteen percent cited other reasons.

DESIRED NEIGHBORHOOD CHANGES. When the kinds of changes people would like to see in their neighborhoods are examined, there is further evidence for assuming that those living next to an embanked facility are more affected by the dirt and noise of the expressway than those living near a depressed road. Roughly the same proportion of people mentioned expressway related changes when they were asked what kinds of changes they would like in their neighborhoods, but a higher proportion of the embanked sample mentioned the reduction of dirt and noise specifically: sixteen percent of those living adjacent to the embanked mentioned a reduction of dirt and noise, compared to three percent of those living adjacent to the depressed. Reduction of dirt and noise was a change that only people living adjacent to the expressways mentioned at all.

DANGERS DUE TO EXPRESSWAYS. Over half--fifty-three percent--of the respondents felt that there were no dangers to them or to their children in their neighborhoods and only twenty-one percent of the dangers mentioned were directly related to the expressway. There was little difference in the percent of expressway-related dangers between the two profiles of the Kennedy, but the Congress tended to generate considerably fewer. This suggests that since the Congress is bordered by streets and guard rails which are plainly visible from the fronts of houses facing it, unlike the Kennedy, people feel less apprehensive about their children playing near it.

A significant difference emerges when the proportion of expressway-related dangers is considered in terms of distance: twenty-six percent and twenty-five percent of the dangers were expressway-related by people living adjacent and one to two blocks away. Here, the decrease in expressway-related effects begins to decline only after three blocks, unlike other effects which show a decline after a distance of one block.

IMPACT OF MASS TRANSIT. Fourteen percent of the entire sample have no car at all. Of these, eighty-five percent do not want a car either because they feel they are too old, or because they do not know how to drive. Twenty-three percent of the respondents have two or more cars in their homes and only twelve percent of those who have one car would like to have a second. Not having a car does not depend on the availability of rapid transit since the same proportion of people living in the Congress area and the Kennedy area have cars, despite the functioning mass transit rail service on the Congress Expressway.

The availability of rapid transit has a strong influence on how people get to work, however. One-third of those who are employed and live in the Congress area use public transportation--compared to only thirteen percent who live within the Kennedy

area.

The proportion of people who have cars but do not use the expressway is slightly higher for the Congress sample than for the Kennedy sample, as would be expected because of the mass transit. Surprisingly, those closest to the expressway tend to use it least of those people who have cars: fifteen percent of the adjacent sample, twelve percent of those living one to two blocks away and only six percent of those living three to four blocks away do not drive on the expressway, and the availability of rapid transit on the Congress does not account for this difference.

In addition, the availability of rapid transit seems to have little effect on the use of public transportation in general (buses, etc.) since forty-one percent of those living near both expressways never use public transportation of any sort. Of those who do use public transportation, however, almost three-fourths, or seventy-one percent, use it to get to the central business district.

EFFECTS OF NEIGHBORHOOD TRAFFIC. Highway design has no effect on whether people feel the traffic on their street has gotten heavier, remained the same or gotten lighter. However, the relationship between distance and neighborhood traffic shows that the further away from the expressway the more people feel the neighborhood traffic has gotten heavier: thirty-four percent of the adjacent sample, forty-one percent of the one to two block sample, and forty-four percent of the three to four block sample said they feel their neighborhood traffic had increased since the expressway was built. Although a slightly higher proportion of the total embanked sample said their neighborhood traffic had gotten heavier, the smallest proportion of those living adjacent to the embanked felt the traffic was heavier.

EFFECT ON PROPERTY VALUES. When asked what effect they felt the expressway had on the value of property in the area, thirty-five percent of the total sample said they thought it was worth less and thirteen percent said they didn't know.

Almost all--ninety-five percent--of those who said it was worth less live adjacent to the expressway: half adjacent to the depressed and half adjacent to the embanked. Of those who said property was worth more, the highest proportion--forty-one percent--live adjacent to the expressway. Here, the extreme reactions are found among those adjacent and indicate their tendency to emphasize positive as well as negative features of their immediate environment, while highway design itself makes no difference.

RESPONDENTS' PROPERTY VALUES

Rating	Distance		
	Adjacent	1-2 Blocks	3-4 Blocks
Worth more	29%	56%	47%
Worth the same	37%	30%	39%
Worth less	21%	2%	-

	Profile	
	Embanked	Depressed
Worth more	34%	47%
Worth the same	50%	28%
Worth less	2%	13%

REACTIONS TO EXPRESSWAY ANNOUNCEMENTS. Of the fifty-three percent of the total sample that remembered the announcements of the expressways, thirty-five percent suffered actual damage, feared damages, or were generally against the proposal. Twenty-three percent said they didn't care and thirty-seven percent approved of the plans or accepted them as inevitable. Naturally those living adjacent were most negative in their attitudes: fifty-eight percent feared suffering or actually suffered because of the expressways. By contrast, only sixteen percent of those living one to two blocks away and sixteen percent of those living between three and four blocks away remembered having had negative feelings about the proposals. This indicates that once the distance exceeds one block, the same proportion of people is going to have negative feelings about the proposals.

There is a difference, however, between the two non-adjacent samples in terms of neutral and positive feelings. Nineteen percent of both the adjacent sample and the one to two blocks away sample stated that they hadn't cared or weren't concerned when the plans were announced. In contrast, thirty-seven percent of those living between three to four blocks away said the proposed highway hadn't concerned them at all. Indifference,

then, is something that increases with distance, while negative feelings stabilize after one is beyond the first block.

Very few people engaged in protest activities of any kind as a result of their negative feelings about the expressways. Only seven percent of those who remembered the announcements engaged in any such activities, and sixty-two percent of these people lived adjacent to the expressways. The remaining thirty-eight percent of protesters lived between one and two blocks away, while no protesters were found among the three to four block sample.

EFFECTS OF EXPRESSWAYS ON RESPONDENTS LIVES. When asked to assess the effect that the expressway has had on their lives, nineteen percent of the respondents stated that there was no effect, fifty-seven percent mentioned positive effects, and twenty-four percent mentioned negative effects. As would be expected, the further away from the expressway the smaller the proportion of people emphasizing the negative effects of the roads. Thirty-eight percent of the adjacent sample, seventeen percent of the one to two block sample, and only four percent of the three to four block sample mentioned that they felt the effects of the freeway were predominantly negative.

The increase in positive effects is not gradual as one moves away from the expressways, however. Forty-six percent of those living adjacent assessed the overall effects of the expressways as positive compared to sixty-five percent of those living one to two blocks away and sixty-two percent of those living three to four blocks away. There is a definite break between the adjacent sample and the one to two block sample, indicating that the same proportion of the non-adjacent samples--slightly less than two-thirds--feel the expressway has generally made their lives better. This improvement was seen mainly in terms of the convenience afforded by the expressways.

Indifference is something that rises significantly for the furthest sample: one-third of those three to four blocks away, compared to fifteen percent for the adjacent sample, and eighteen percent of the three to four block sample said that the expressways had not made any difference to their lives. The difference between the depressed and embanked samples are negligible, indicating that the degree of negativity, positivity or indifference toward the expressway is mainly a function of distance.

The reasons people give for wanting to move generally do not relate to the expressways, but when they do, distance again is the key variable. Of the total sample, forty-five percent said they would like to move, but only eleven percent of those cited the expressway as the reason they wanted to move. Most important, all of those who said that the expressway was the reason they wanted to move, live adjacent to it.

SUMMARY OF FINDINGS. Supporting noise and air pollution studies, the findings indicate that noise and air pollution are a greater disturbance to residents living adjacent to the embanked expressway than the depressed expressway. However, nearness to the expressway, rather than the pollution generated by it, is the reason most often cited by residents for wanting to move, when the expressway itself is the cause of their desire to move. Whether the respondents who want to move because of the expressway live adjacent to the embanked or depressed makes no difference: it is that they live adjacent to the expressway.

People living adjacent to the expressways also have more extreme reactions to what they feel are the advantages and disadvantages of living so close, than the residents who live one to two blocks away, and those who live three to four blocks away. Adjacent residents feel they must justify their remaining so close by emphasizing the positive aspects of the expressways, as well as mentioning the inevitable negative aspects.

While the above findings relate primarily to differences between the adjacent, one to two block, and three to four block samples, the major finding relating to the expressway design concerns the extent to which a depressed expressway poses more of a neighborhood barrier than an embanked expressway. The explanation of this lies primarily in terms of what residents see when they are next to, and when they cross the facilities. When one crosses a 250 foot wide depressed expressway, one must travel over a fast moving river of traffic. When one crosses an embanked expressway of the same width, all that is visible is the viaduct and the continuation of the city on the other side. What stands out for people crossing the depressed expressway is the traffic below, while the most salient visual feature for those crossing the embanked is the continuation of the city on the other side.

The same distinction is the case for the residents living adjacent to both types of expressway. Residents living adjacent to the embanked expressway see only a grassy slope from their windows, as long as they live on the first two floors of the building. Residents adjacent to depressed expressways, on the other hand, look directly into the river of traffic. The advantages of a depressed expressway in terms of people being able to look across it to the

other side where the community continues are offset by the prominence of the traffic below only in cases where the width of the road is narrow enough to permit this within a very short distance from the edge of the expressway. With the width involved in these studies, the visual disadvantages of depressed expressways outweigh the advantages.

BIBLIOGRAPHY

GENERAL PLANNING

Donald Appleyard, Kevin Lynch, John R. Myer, The View from the Road, Cambridge, Mass., MIT Press, 1963.

Barton-Aschman Associates, Guidelines for New Systems of Urban Transportation: Vol. 1--Urban Needs and Potentials, prepared for the Urban Transportation Administration, US Department of Housing and Urban Development, May 1968.

----------, Joint Project Concept: Integrated Transportation Corridors, prepared for the US Department of Housing and Urban Development, January 1968.

Dwight M.B. Bauman, Compatible Automation of New Town Transportation, Institute of Public Administration, Washington DC, December 1969.

Alexander Ganz, Emerging Patterns of Urban Growth and Travel, prepared for MIT Project Transport, Department of City and Regional Planning, MIT, 1968.

Lawrence Halprin, Freeways, New York, Reinhold, 1966.

Clark Henderson, et. al., Final Report I--Future Transportation Systems: Descriptions, Evaluations, and Programs, prepared for the Urban Transportation Administration, US Department of Housing and Urban Development, March, 1968.

Fran P. Hosken, The Language of Cities, New York, Macmillan, 1968.

Landscape Architecture Research Office, Harvard University Graduate School of Design, Highway Esthetics: Functional Criteria for Planning and Design, June 1968.

Kevin Lynch, The Image of the City, Cambridge, Mass., Harvard and MIT Presses, 1960.

"New Concepts in Urban Transportation Systems," special issue of the Journal of the Franklin Institute, November 1968.

Pennsylvania Transportation and Traffic Safety Center, Pennsylvania State Univeristy, Methodological Framework for Comprehensive Transportation Planning, prepared for the Governor's Committee for Transportation, no date.

Urban Advisors to the Federal Highway Administrator, The Freeway in the City: Principles of Planning and Design, prepared for the Secretary, US Department of Transportation, Washington DC, US Government Printing Office, 1968.

US Department of Transportation, Federal Highway Administration, A Report on the Status of Multiple Use and Joint Development, no date.

John Robert White, "George Washington Bridge Approach: A Case Study," Appraisal Journal," Vol. 34, January, 1966, pp. 32-40.

IMPACT OF URBAN EXPRESSWAYS

Brian Berry, Sandra Parsons, Rutherford H. Platt, The Impact of Urban Renewal on Small Business, prepared for the Center for Urban Studies, University of Chicago, in cooperation with the US Department of Housing and Urban Development, 1968.

Robert A. Burco, and David A. Curry, Final Report II -- Future Urban Transportation Systems: Impacts on Urban Life and Form, prepared for the Urban Transportation Administration, US Department of Housing and Urban Development, March 1968.

David C. Colony, Study of the Effect, if any, of an Urban Freeway upon Residential Properties Contiguous to the Right-of-Way, prepared for the State of Ohio Department of Highways, no date.

Raymond H. Ellis, "Toward Measurement of the Community Consequences of Urban Freeways," Highway Research Record, No. 277, pp. 25-39.

Gordon Fellman, "Neighborhood Protest of an Urban Highway," Journal of the American Institute of Planners, Vol. XXXV, No. 2, March 1969, pp. 118-122.

Highway Research Section, Engineering Research Division,

Washington State University, A Study of the Social, Economic, and Environmental Impact of Highway Transportation Facilities on Urban Communities, 1968.

Dennis R. Neuzil, Some Social Impact Aspects of Urban Freeways, The Institute of Transportation and Traffic Engineering, University of California, March 1964.

Jeremiah D. O'Leary Jr., "Evaluating the Environmental Impact of an Urban Expressway," Traffic Quarterly, Vol. XXIII, No. 3, July, 1969, pp. 341-351.

P. H. Parkin and H. J. Purkis, London Noise Survey, London, Her Majesty's Stationery Office, 1968.

Urban Research, Inc., Center City: Business and Investment Opportunities in Central Boston, 2 Vols., prepared for Boston Urban Foundation, September 1969.

Urban Systems Laboratory, Massachusetts Institute of Technology, The Impacts of Highways on Environmental Values, prepared for Highway Research Board, National Cooperative Highway Research Program, National Academy of Sciences, March 1969.

SOUTHWEST CORRIDOR

Black and White in Boston, A Report Based on the Community Research Project, prepared for the United Community Services of Metropolitan Boston, May 1968.

Boston Revelopment Authority, Inner Belt--Southwest Expressway: Summary Relocation Report, January 1967.

----------, Transportation Planning Department, Transportation Facts for the Boston Region, 1968-1969 edition.

Brown Professional Engineers, Inc., Basic Design Report: Southwest Expressway--Interstate Route 95, prepared for the Massachusetts Department of Public Works, 1966.

Robert Gladstone and Associates, The Southwest Corridor Study Area Development Prospects, prepared for the Southwest Corridor Study Committee, Washington DC, March 1969.

----------, The Southwest Corridor Study Area: Analysis of Alternative Land Use Plans, prepared for the Southwest Corridor Study Committee, Washington DC, August 1969.

The Impact of the Proposed Southwest Corridor Expressway on Jamaica Plain, prepared by a working group from the Jamaica Plain Community Council, Jamaica Plain Area Planning Action Council, Community Leadership Center, Mendell Neighborhood Association, and Brookside Neighborhood Association, assisted by Urban Planning Aid, Inc., January 1968.